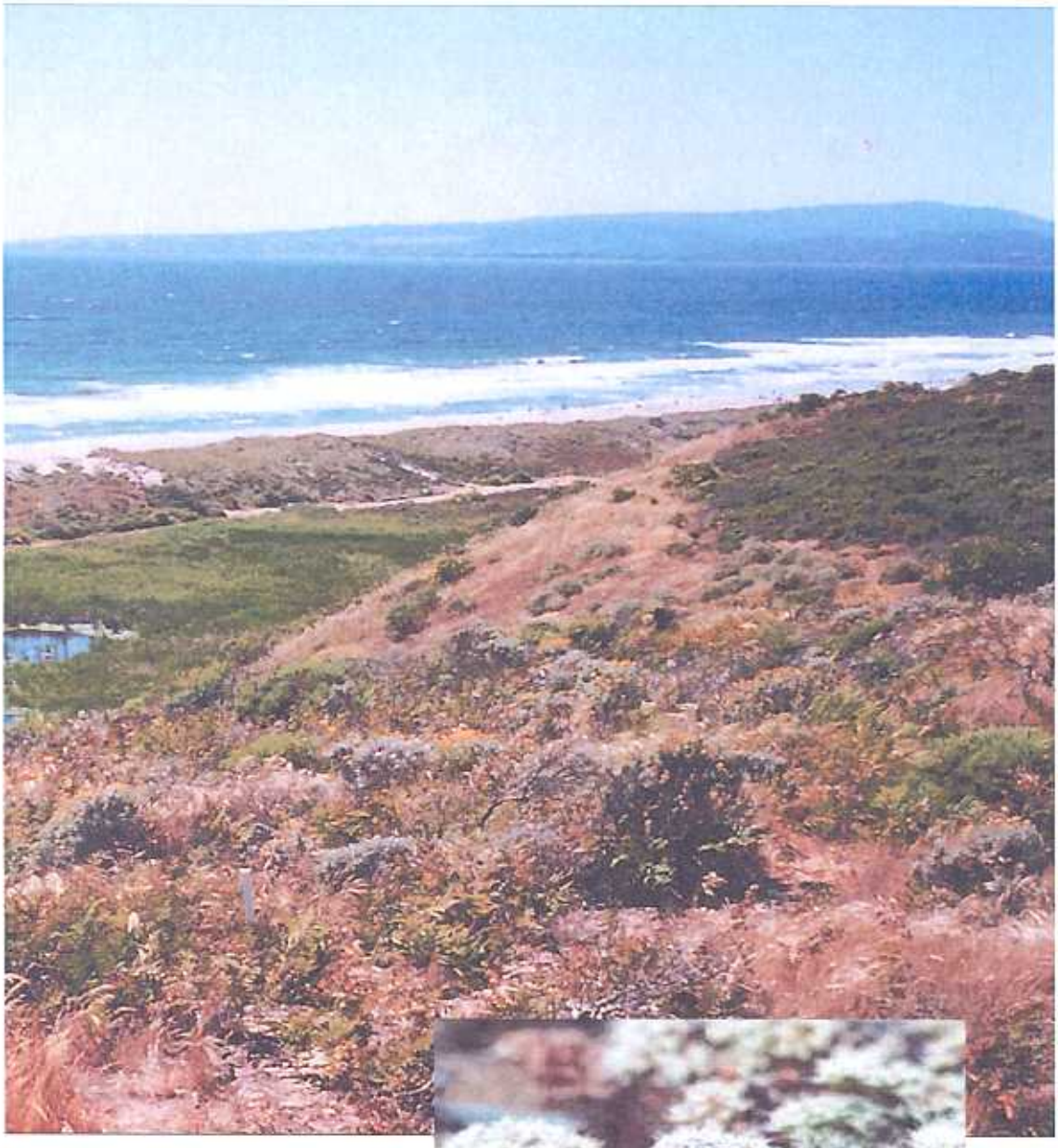
Recovery Plan for
Chorizanthe robusta var. *robusta*
(Robust Spineflower)



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for

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(Robust Spineflower)

Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

Approved: _____
Manager, California/Nevada Operations Office
Region 1, U.S. Fish and Wildlife Service

Date: AUG 23 2004

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Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. We, the U.S. Fish and Wildlife Service, publish recovery plans, sometimes preparing them with the assistance of recovery teams, contractors, State agencies, and other affected and interested parties. Plans are reviewed by the public and submitted to additional peer review before we adopt them. Objectives of the plan will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific actions and may not represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation other than our own. They represent our official position **only** after they have been signed by the Regional Director, Director or California/Nevada Operations Manager as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions.

Literature Citation Should Read As Follows:

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An electronic version of this recovery plan will also be made available at: http://pacific.fws.gov/ecoservices/endangered/recovery/default.htm and at http://endangered.fws.gov/recovery/index.html#plans.

ACKNOWLEDGMENTS

This recovery plan was prepared by Constance Rutherford, botanist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office. Kirk Waln of the Ventura Fish and Wildlife Office produced the maps.

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EXECUTIVE SUMMARY

Current Status: *Chorizanthe robusta* var. *robusta* (robust spineflower), which is federally endangered, is restricted to sandy soils along the coast and near-coastal areas in Santa Cruz and Marin Counties, California. It is currently known from 10 sites that support a total of 12 populations. At the time the draft recovery plan was prepared, we were only aware of four sites. In the intervening years, greater awareness of the species generated through the original listing and subsequent designation of critical habitat has resulted in surveys that have located additional populations. Of the 10 sites now known, 3 are on park lands (Sunset State Beach, Santa Cruz County; and Abbots Lagoon and South Kehoe Creek at Point Reyes National Seashore, Marin County) that support large populations on the order of 10,000 individuals or more. The other seven sites support significantly smaller populations. Three of these sites are on lands that are or have the potential to be managed for the conservation of the species: Pogonip Park in the City of Santa Cruz (including two populations), Ellicott Slough National Wildlife Refuge (including the Buena Vista and Ellicott populations), and Manresa State Beach. The remaining four sites are on private lands with varying opportunities to pursue conservation activities. These private parcels are named Baldwin Creek, Branciforte, Aptos, and Freedom.

Habitat Requirements and Limiting Factors: *Chorizanthe robusta* var. *robusta* is found on sandy soils in coastal and near-coastal areas from Santa Cruz south to Sunset State Beach in Santa Cruz County, and on Point Reyes National Seashore in Marin County.

Chorizanthe robusta var. *robusta* is threatened by urban development, recreational activities, and competition with nonnative vegetation. In addition, the low numbers of individuals and populations of this taxon put it at great risk of extinction due to random, naturally occurring (stochastic) disturbance.

Recovery Priority Number: 9, per criteria published in the Federal Register (U.S. Fish and Wildlife Service 1983). The priority number indicates that

Chorizanthe robusta var. *robusta* is an infraspecific taxon with a moderate degree of threat and a high recovery potential.

Recovery Goal: The recovery goal for *Chorizanthe robusta* var. *robusta* is to conserve viable and self-sustaining populations in its natural habitat such that protection of the Endangered Species Act is no longer necessary.

Recovery Criteria:

Chorizanthe robusta var. *robusta* will be considered for downlisting when:

> 1) Eleven populations of *Chorizanthe robusta* var. *robusta* in four recovery units distributed through the species' range have been protected, either through an approved and implemented management plan, or through a conservation easement;
> 2) Habitat in each protected population has been appropriately managed and restored; and
> 3) Population monitoring shows a stable or increasing trend in population size or density over 10 years.

Chorizanthe robusta var. *robusta* will be considered for delisting when:

> The total number of populations has increased to at least 18, at least 15 of which have an average population of 1,000 individuals in a normal rainfall year over at least 10 years beyond the downlisting monitoring period. This could be achieved by a combination of the following: a) discovering additional populations, and/or b) establishing new populations through an outplanting program. The populations would need to be self-sustaining, and be protected through conservation measures equivalent to those in the downlisting criteria above.

Actions needed:

1. Protect existing habitat.
2. Manage existing habitat through implementation plans.
3. Conduct management-oriented research on the taxonomy, ecology, biology, and management of *Chorizanthe robusta* var. *robusta*.
4. Establish new populations within the historical range of the species.
5. Review and revise recovery guidelines.
6. Develop and implement an outreach program.

Date of Downlisting: If the proposed recovery actions are successful and downlisting criteria are met, downlisting from endangered to threatened could be considered by 2014; if delisting criteria are met, delisting could be considered by 2024. An evaluation of population viability for *Chorizanthe robusta* var. *robusta* should be done after 5 years to assess the progress that has been made toward meeting the downlisting criteria, and a more specific target date set at that time.

Estimated Cost to Achieve Recovery: $376,000 plus costs to be determined.

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I. INTRODUCTION

A. BRIEF OVERVIEW

Chorizanthe robusta var. *robusta* (robust spineflower) is restricted to sandy soils along the coast and near-coastal areas in Santa Cruz and Marin Counties, California. We published the final rule determining its Federal endangered status in the Federal Register on February 4, 1994 (U.S. Fish and Wildlife Service 1994); this rule listed the entire species *C. robusta* as endangered, including both *C. robusta* var. *robusta* and *C. robusta* var. *hartwegii* (Scotts Valley spineflower). Recovery criteria and actions pertaining to *C. robusta* var. *hartwegii* have previously been fully addressed in the Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California (U.S. Fish and Wildlife Service 1999). Because *C. robusta* var. *robusta* is geographically and ecologically distinct from *C. robusta* var. *hartwegii*, its recovery needs are being addressed separately in this recovery plan.

The draft recovery plan for *Chorizanthe robusta* var. *robusta* (U.S. Fish and Wildlife Service 2000a) was released for agency and public comment in September of 2000 (U.S. Fish and Wildlife Service 2000b). As a result of a lawsuit settlement, we published a proposed critical habitat designation in February 2001, and the final critical habitat designation in May 2002 (U.S. Fish and Wildlife Service 2002). During the course of designating critical habitat, we obtained new information concerning the status and distribution of *C. robusta* var. *robusta*. Therefore, this final recovery plan includes a number of changes from the draft recovery plan. These can be summarized as follows:

- seven new populations are described
- additional information concerning the life history is included
- a section on critical habitat and special management considerations has been added

Chorizanthe robusta var. *robusta* has a recovery priority of 9. Recovery priorities for listed species range from 1 to 18, with 1 being the highest priority. A priority of 9 indicates a subspecies facing a moderate degree of threat and a high potential for recovery (see Appendix A). We have lowered the recovery priority to 9 from the previously published priority number of 3 in the draft recovery plan because the discovery of seven additional populations, two of which are quite large, has reduced the degree of threat from high to moderate.

B. TAXONOMY AND DESCRIPTION

The robust spineflower was first described as *Chorizanthe robusta* by Charles Parry in 1889 based on a collection he made 6 years earlier "north of Aptos along Monterey Bay" (Parry 1889). Willis Jepson considered it to be a variety of *C. pungens* and thus combined the taxon under the name *C. pungens* var. *robusta* in his Flora of California in 1913 (Jepson 1913). In their revision of the genus in 1989, Reveal and Hardham (1989) recognized Parry's treatment and retained the taxon as *C. robusta*. Shortly thereafter, Reveal and Morgan (1989) described a variety of *C. robusta*, the variety *hartwegii*, from the Santa Cruz Mountains (Scotts Valley spineflower). The coastal variety of this species is recognized as *Chorizanthe robusta* var. *robusta* (Figure 1).

Chorizanthe robusta var. *robusta* is an annual spineflower in the *Pungentes* section of the genus *Chorizanthe* in the buckwheat family (Polygonaceae) (Figure 1). Like other spineflowers, it is branched from the base and subtended by a rosette of basal leaves. The plant has an erect to spreading or prostrate habit, usually standing not more than 20 centimeters (8 inches) high. The whorl of

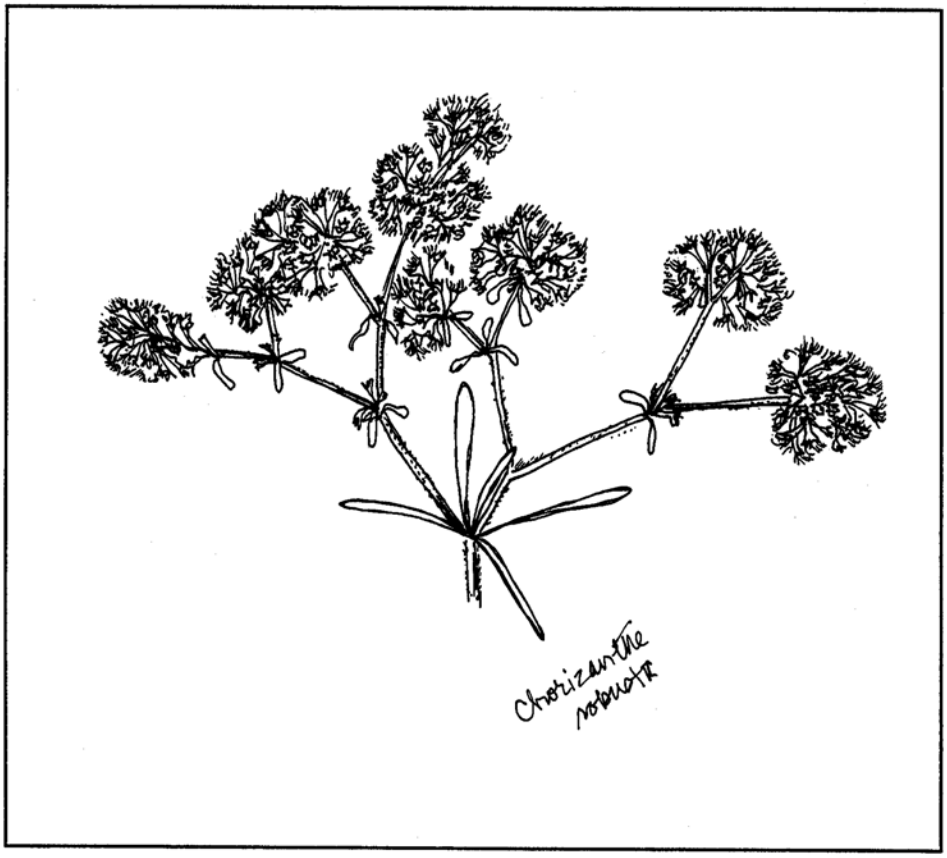

Figure 1. Illustration of *Chorizanthe robusta* var. *robusta*. Illustration by Sharon Erspamer. Used with permission of the City of Santa Cruz.

bracts subtending the flowers (involucres) has thin white to pinkish scarious (thin and translucent) margins along the basal portions of the teeth. Relative to other spineflower taxa in the *Pungentes* section, the flower heads are large (1.5 to 2.0 centimeters [0.6 to 0.8 inch]) in diameter and distinctly aggregate.

Because of the close relationship between several species of *Chorizanthe* in the *Pungentes* section and the plasticity of some of the morphological characteristics used to identify them, there has been confusion as to the identity of certain specimens that have been collected (Ertter 1990, 1996). In particular, specimens collected from the coastal dune areas near Sunset State Beach and just inland near Rob Roy Junction and Buena Vista have been variously identified as *C. pungens* var. *pungens* (Monterey spineflower) (Bill Davilla, Ecosystems West, pers. comm. 1998) or *C. robusta* var. *robusta* (S. Baron *in litt.* 1995, Morgan and Kiguchi 1995, California Natural Diversity Data Base 1997). Moreover, Ertter has pointed out that there is another coastal "phase" of *Chorizanthe*, which may be distinct from both Monterey spineflower and robust spineflower, and which keys out as Monterey spineflower with the current identification key (Hickman 1993).

Since the draft recovery plan was prepared, two additional populations of spineflower located at Point Reyes National Seashore have been identified as *Chorizanthe robusta* var. *robusta* by Ertter (B. Ertter *in litt.* 2001). These new populations co-occur with *C. cuspidata* var. *cuspidata* (San Francisco Bay spineflower) and *C. cuspidata* var. *villosa* (woolly-headed spineflower), two other members of the *Pungentes* complex (J. Rodgers *in litt*. 2003).

To assist in distinguishing between the varieties of *Chorizanthe* in the *Pungentes* section that have hooked involucral teeth, Barbara Ertter (*in litt.* 1997) has prepared a key to distinguish between these taxa (Table 1). Experts, however, acknowledge that the distinction between species in the *Pungentes* section of the genus in the Monterey Bay area merits additional attention (Ertter 1990, 1996). In addition, the recent discovery of *C. robusta* var. *robusta* co-occurring with other members of the *Pungentes* section at Point Reyes National Seashore may pose a similar challenge.

Table 1. Key to varieties of *Chorizanthe robusta*, *C. pungens*, and related species of subsect. *Pungentes* with hooked involucral teeth. Based in part on Reveal and Hardham 1989, Reveal and Morgan 1989; as modified by B. Ertter *in litt.* 1997.

1. Plants erect, up to 5 dm high; heads distinct,1-2 cm wide; involucres with a white to pink or purplish scarious margin

2. Heads > 1 cm wide, white or rose; involucres 2.5-4 mm long; tepals erose to denticulate or distinctly cuspidate . . . *C. robusta* C. Parry

3. Heads ca. 1.5-2 cm wide, white; hills from Santa Cruz to Aptos, historically in Alameda and Colma . . . *C. robusta* var. *robusta* [phase 1]

3' Heads ca. 1-1.5 cm wide, rose-pink; Santa Cruz Mts. near Scotts Valley.. . . *C. robusta* var. *hartwegii* (Benth.) Rev. & R. Morgan [phase 2]

2' Heads to 1 cm wide, pink; involucres 2-2.5(3) mm long; tepals erose apically, not cuspidate; Santa Cruz Mountains . . . *C. pungens* Benth. var. *hartwegiana* Rev. & Hardham [phase3]

1' Plants prostrate or decumbent to ascending, mostly less than 2.5 dm high; heads often indistinct, if distinct then to 1 cm wide

4. Involucres 3-4 mm long, bordered with a conspicuous white margin; heads indistinct; lower end of Salinas Valley from Watsonville to Montery Peninsula . . . *C. robusta* var. nov.? [phase 5]

4' Involucres 1.5-2.5(3) mm long, with or without a scarious margin; heads indistinct or distinct

5. Tepals erose to cuspidate apically, the flowers white to rose, pubescent, 2-3 (3.5) mm long; involucral tube with or without a scarious margin; stamens 3 or 6-9

6. Tepals erose apically, not cuspidate; involucral teeth uncinate; Santa Cruz and Monterey cos. south to Santa Barbara Co.

7. Involucres distinctly margined, the margin white or pink, the tube 2-2.5(3) mm long, the anterior awn 2-3 mm long; flowers 2-3.5 mm long; stamens 9; coastal beaches and inland mountains of Monterey and Santa Cruz cos. . . . *C. pungens* Benth.

8. Involucral lobes with white (rarely pinkish) scarious margins; plants prostrate to slightly ascending; heads distinct or indistinct; coastal areas and inland into Salinas Valley . . . *C. pungens* var. *pungens* [phase 4]

8' Involucral lobes with pinkish scarious margins; plants slightly ascending to erect; heads distinct; Santa Cruz Mountains . . . *C. pungens* Benth. var. *hartwegiana* Rev. & Hardham [phase3]

7' Involucres not margined (or if so, then the margin pinkish but hardly conspicuous), the tube1.5-2(2.5) mm long, the anterior awn 1.5-2.5 mm long; flowers 2-3 mm long; stamens 3 or 6-9; coastal mesas and foothills of San Luis Obispo and Santa Barbara cos. . . . *C. angustifolia* Nutt.

6' Tepals cuspidate, pubescent the entire length with the hairs usually extending beyond the apex; involucres 1.5-3 mm long, the awns uncinate or straight, with or without scarious margins, the anterior awn 2-3 mm long; flowers 2-3 mm long; San Francisco peninsula from northern San Mateo Co., northward to Marin and Sonoma cos., historically in Alameda . . . *C. cuspidata* S. Watson

5' Tepals entire apically, the flowers distinctly bicolored with a lemon-yellow tube and white lobes, glabrous, 2.5-3 mm long; involucral tube with a distinct scarious margin; stamens 3-9; foothills and mountains of the Coast Ranges from Santa Cruz and Monterey cos. southward through San Luis Obispo to western Santa Barbara Co. . . . *C. diffusa* Benth.

The resolution of taxonomic issues will bear upon the recovery of *Chorizanthe robusta* var. *robusta* and closely related taxa in several ways. If, in the future, taxonomic studies indicate that *C. robusta* var. *robusta* is even more narrowly defined than it is at present, certain recovery actions (*e.g*., introductions to historical or other suitable sites) will need to ensure that the correct taxa are being utilized. In addition, the status of any taxa at sites that had been previously identified as supporting *C. robusta* var. *robusta* will have to be reevaluated. Should these taxa be as rare as or rarer than *C. robusta* var. *robusta*, then the conservation and recovery measures for them would be similar to those outlined in this recovery plan. If taxonomic studies indicate that *C. robusta* var. *robusta* is more broadly defined than previously believed, this knowledge may change our view of how aggressive we need to be with recovery actions. We believe that clarifying the taxonomic relationships between members of the *Pungentes* section and assessing the true status of *C. robusta* var. *robusta* and other related sensitive taxa is a pivotal task that should be undertaken as soon as possible.

C. LIFE HISTORY

Chorizanthe robusta var. *robusta* is a short-lived annual plant. It germinates during the winter months and generally flowers from April through June; however, if climatic conditions are favorable, some individuals may continue to flower throughout the summer. Murphy (2003) expanded on observations of pollinators initiated by S. Baron (in litt. 2000) and R. Morgan (pers comm. 2000). At the two sites she observed (Sunset Beach and Pogonip), insects from the orders Diptera, Hymenoptera, Lepidoptera, and Coleoptera were frequent visitors. In addition Hemiptera (true bugs) were also frequent visitors to *C. robusta* var *robusta* at Pogonip (Murphy 2003). Within these orders, 14 insect families were frequent visitors at Sunset, and 13 frequent families at Pogonip. The diversity of insects found on this plant is comparable to that of some other generalist pollination systems.

Murphy (2003) researched several aspects of *Chorizanthe robusta* var. *robusta* pollination ecology. She found that inflorescences where pollinators were excluded, and that therefore were only self-pollinated, had only 19 percent of the seed set found in inflorescences where pollinators were not excluded. Therefore,

although *C. robusta* var. *robusta* is self-compatible, insect pollination greatly increases seed production. The germination rates of the seed resulting from self-pollination was not significantly different from seed resulting from cross-pollination by insects, though it is possible that if there were a reduced fitness of seed resulting from self-pollination, it may show up in later stages of plant development. In an often cool and windy environment, such as along the coast, pollinators may be unreliable. The ability to self-pollinate ensures that some amount of seed set will occur if cross pollination by insects does not occur (Moldenke 1976). Murphy observed that the probability of any one flower being visited by a pollinator was lower at the coastal site (Sunset) than at the more inland site (Pogonip).

In other annual species of *Chorizanthe*, the flowers are protandrous, a reproductive strategy in which the anthers (part of flower that produces pollen) mature and shed pollen prior to the maturation of the style (part of the female reproductive structure of a flower) to receive pollen, with a delay of style receptivity of 1 or 2 days. Protandry facilitates cross-pollination by insects. However, if cross-pollination does not occur within 1 or 2 days, self-pollination may occur as the flower closes at the end of the day (Reveal 2001). Murphy also found that, while *C. robusta* var. *robusta* is protandrous like other species in the genus, self-pollination cannot occur until the third and last day of flowering, which may indicate an even greater propensity for outcrossing.

Baron (1998) tracked the phenology of 100 individual *Chorizanthe robusta* var. *robusta* seedlings on the Buena Vista parcel in 1997. Out of 100 seedlings, 42 percent survived to flowering. Causes of mortality included desiccation prior to flowering (52 percent), herbivory (4 percent), and uprooting by gophers (*Thomomys bottae*) (2 percent). Among plants that survived to flowering, flower production was positively correlated with basal diameter, with the largest individuals producing upwards of 50 flowers; each flower produces one seed.

Seed is mature by August. The plants turn a rusty hue as they dry through the summer months, eventually shattering during the fall. Seed dispersal is facilitated by the involucral spines, which attach the seed to passing animals. Rabbits (*Sylvilagus bachmani*) have been observed to browse on *Chorizanthe robusta* var.

robusta (Baron 2002), and most likely act to disperse seeds as well. Other small mammals (such as fox, coyotes, ground squirrels, skunks, racoons, and chipmunks) and birds are potential seed dispersers. While animal vectors most likely facilitate dispersal between populations, or within portions of populations, the prevailing coastal winds undoubtedly play a part in scattering seed within colonies and populations.

Maintaining a seed bank (a reserve of dormant seeds, generally found in the soil) is important to the year-to-year and long-term survival of annual plants (Baskin and Baskin 1975, Baskin and Baskin 1998). A seed bank includes all the mature seeds in a population and generally covers a larger area than the extent of observable plants seen in a given year (Given 1994). The number and location of standing plants (the observable plants) in a population varies annually due to a number of factors, including the amount and timing of rainfall, temperature, soil conditions, and the extent and nature of the seed bank. The extent of seed bank reserves are variable from population to population and large fluctuations in the number of standing plants at a given site may occur from one year to the next.

Herbivory by insects could reduce population viability of *Chorizanthe robusta* var. *robusta* by reducing seed output. Baron (2002) also compared seed output of patches of *C. robusta* var. *robusta* where microlepidopteran larvae in the genus *Aroga* (Gelichiidae) were excluded and compared the seed output to patches where the larvae were allowed to forage, and found a 58 percent increase in seed output in the former. In addition, rabbits removed seed heads from 11 percent of the plants under study.

D. HABITAT DESCRIPTION AND CRITICAL HABITAT

The designation of critical habitat for *Chorizanthe robusta* var. *robusta* provided the opportunity to look more closely at the physical and biological characteristics of habitat (called the primary constituent elements) that are essential to the conservation of the species, and that may require special management. We identified four primary constituent elements in the critical habitat designation for *C. robusta* var. *robusta*:

1. Sandy soils associated with active coastal dunes and inland sites with sandy soils. The origin of the soils, whether from active dunes or interior fossil dunes, appears unimportant. The most prevalent soil series represented are Baywood, Ben Lomond, Zayante, Tierra, and Watsonville. At Pogonip, the sandy soils are thought to be derived from the Santa Margarita sandstone formation (John Gilchrist and Associates 1986, Habitat Restoration Group 1996). Sandy soils tend to be nutrient-poor, which limits the abundance of other herbaceous species that can grow on them. Onsite accumulation of duff and litter or the addition of nutrients (*e.g.*, fertilizers) to these naturally nutrient-poor soils may allow for the establishment of other competing species.

2. Plant communities that support associated species, including coastal dune, coastal scrub, grassland, maritime chaparral, and oak woodland communities, and have a structure such that there are openings between the dominant elements (*e.g.*, scrub, shrub, oak trees, clumps of herbaceous vegetation). The species found associated with *Chorizanthe robusta* var. *robusta* vary according to the plant communities present at each site. For instance, at Sunset State Beach, coastal scrub species include *Eriophyllum staechadifolium* (seaside woolly sunflower), *Artemisia pycnocephala* (coastal sagewort), *Ericameria ericoides* (mock heather), and *Baccharis pilularis* (coyote bush). In open patches between these shrubs, *Chorizanthe robusta* var. *robusta* occurs with other herbs and grasses including the following: *Camissonia chieranthifolia* (beach evening primrose), *Eschscholzia californica* (California poppy), *Linaria canadensis* (blue toadflax), *Cryptantha* sp. (cryptantha), *Lupinus* sp. (lupine), *Gnaphalium bicolor* (Bioletti's cudweed), and the nonnative grasses *Avena fatua* (wild oats) and *Bromus diandrus* (ripgut brome). The closely-related and federally threatened *Chorizanthe pungens* var. *pungens* (Monterey spineflower) grows in a band parallel to *Chorizanthe robusta* var. *robusta* in the foredunes along the beach, and the federally endangered *Gilia tenuiflora* var. *arenaria* (sand gilia) occurs sympatrically with *Chorizanthe robusta* var. *robusta* in one location (California Natural Diversity Data Base 1997, S. Baron *in litt.* 1999b).

On more inland sites (Pogonip, Buena Vista, and Freedom), *Chorizanthe robusta* var. *robusta* inhabits sandy soils in openings surrounded by coastal scrub, chaparral, or woodland plant communities. Associated species at the Pogonip site

include *Briza mazima* (rattlesnake grass), *Avena fatua*, *Aira caryophyllea* (European hair grass), *Filago gallica* (narrow-leaved filago), *Lotus strigosus* (Bishop's lotus), and *Rumex acetosella* (sheep sorrel) (S. Baron *in litt*. 1999a). The federally-listed Ohlone tiger beetle (*Cicindela ohlone*) also occurs at the Pogonip site. At the Freedom site, *Chorizanthe robusta* var. *robusta* grows in a grass-dominated opening in oak woodland and scrub (California Natural Diversity Data Base 1997).

At the Buena Vista site, *Chorizanthe robusta* var. *robusta* grows on sandy soils in openings within oak forest and maritime chaparral. The northernmost extent of this uncommon chaparral type occurs at the Buena Vista site and the surrounding area, and includes *Arctostaphylos hookeri* (Hooker's manzanita) and *Ceanothus cuneatus* var. *rigidus* (Monterey ceanothus), both species of concern (Van Dyke and Holl 2003), and *Baccharis pilularis* and *Pteridium aquilinum* (bracken fern). Species found associated with *Chorizanthe robusta* var. *robusta* include *Hypochaeris glabra* (smooth cat's-ear), *Clarkia purpurea* ssp. *quadrivulnera* (four-spot), *Erodium cicutarium* (filaree), *Horkelia* sp. (horkelia), *Gnaphalium purpureum* (purple cudweed), *Lotus strigosus*, *L. scoparius* (deerweed), and native and nonnative grasses. Plants were also observed in disturbed areas, "along trails, and where gopher disturbance is high" (S. Baron *in litt.* 1998). The Buena Vista site also supports the federally endangered Santa Cruz long-toed salamander (*Ambystoma macrodactylum*). The Buena Vista parcel begins 0.4 kilometer (0.25 mile) northeast of the Santa Cruz Long-toed Salamander State Ecological Reserve's Ellicott Pond Unit and was recently acquired by the Ellicott Slough National Wildlife Refuge.

3. Plant communities that contain little or no cover by nonnative species which would compete for resources available for growth and reproduction of *Chorizanthe robusta* var. *robusta*. In areas where the sandy soils have been enriched, either through the accumulation of organic matter or importation of other soils, these sandy soils may support abundant herbaceous vegetation which may then compete with *Chorizanthe robusta* var. *robusta*.

4. Physical processes, such as occasional soil disturbance that support natural dune dynamics along coastal areas. Because *Chorizanthe robusta* var.

robusta, like other members of the *Chorizanthe* genus, does not compete well with other species, maintaining areas free of cover and shade from other plants is essential for its long-term persistence. On the coast at Sunset State Beach, *C. robusta* var. *robusta* tends to grow at the base of backdunes in openings of coastal scrub. Dune dynamics include the deposition of sands along the shoreline, which are then blown onshore by the prevailing winds. Dunes can be mobile, with actively migrating younger dunes overriding and partially burying older ones, or older dunes may develop blowouts, which reactivate dune mobility. A reduction in the sand source or physical controls, such as the stabilization of dunes through planting of vegetation, can slow the natural dynamic dune processes (U.S. Fish and Wildlife Service 1998a).

Special Management Considerations or Protections

In addition to identifying the primary constituent elements for *Chorizanthe robusta* var. *robusta*, we have attempted to identify special management considerations or protections that designated critical habitat areas may need in order to ensure that the primary constituent elements are being maintained. In the critical habitat designation for this species, we discussed the six most likely kinds of special management and protection that *C. robusta* var. *robusta* may require:

(1) In near-coastal areas, the supply and movement of sand along the coast must be maintained to create the dynamic dune habitats that are needed for *Chorizanthe robusta* var. *robusta*.

(2) In more interior locations, the sandy soils on which *Chorizanthe robusta* var. *robusta* is found should be maintained to optimize conditions for the species. Physical properties of the soil, such as its chemical composition, salinity, and drainage capabilities would best be maintained by limiting or restricting the use of herbicides, fertilizers, or other soil amendments.

(3) The associated plant communities must be maintained to ensure that the habitat needs of pollinators and dispersal agents are maintained. The use of pesticides should be limited or restricted so that viable populations of pollinators are present to facilitate reproduction of *Chorizanthe robusta* var. *robusta*.

Fragmentation of habitat through construction of roads and certain types of fencing should be limited so that seed dispersal agents may move seed of *C. robusta* var. *robusta* throughout the unit.

(4) In some plant communities, it may be important to maintain a mosaic of different-aged stands of coastal scrub or maritime chaparral patches so that openings that support *Chorizanthe robusta* var. *robusta* will be maintained. Depending on location, the use of prescribed fire, thinning, or other forms of vegetation management may be useful in creating and maintaining this type of mosaic.

(5) In all plant communities where *Chorizanthe robusta* var. *robusta* occurs, invasive, nonnative species such as *Phalaris aquaticus* (harding grass), *Ehrharta* spp. (veldt grass), *Ammophila arenaria* (European beachgrass), *Carpobrotus* spp. (iceplant), and other species need to be actively managed to maintain the open habitat that *C. robusta* var. *robusta* needs.

(6) Certain areas where *Chorizanthe robusta* var. *robusta* occurs may need to be fenced to protect them from accidental or intentional trampling by humans and livestock. While *C. robusta* var. *robusta* appears to withstand light to moderate disturbance, heavy disturbance may be detrimental to its persistence. Seasonal exclusions may work in certain areas to protect *C. robusta* var. *robusta* during its critical season of growth and reproduction.

E. RANGE AND DISTRIBUTION

According to information collated by the California Natural Diversity Data Base (1997), *Chorizanthe robusta* var. *robusta* once ranged from Alameda County, on the eastern side of San Francisco Bay, south to Monterey County - a range of 100 kilometers (65 miles) (Figure 2). However, the identity of the Alameda collections is still unresolved; Reveal and Hardham (1989) noted that these collections may be more closely related to *C. cuspidata* or *C. valida*, but that resolution of the question is unlikely since the Alameda population was last collected in 1948 and no longer exists. Aside from the Alameda collections, it is interesting to note that some of the other historical collections were located at

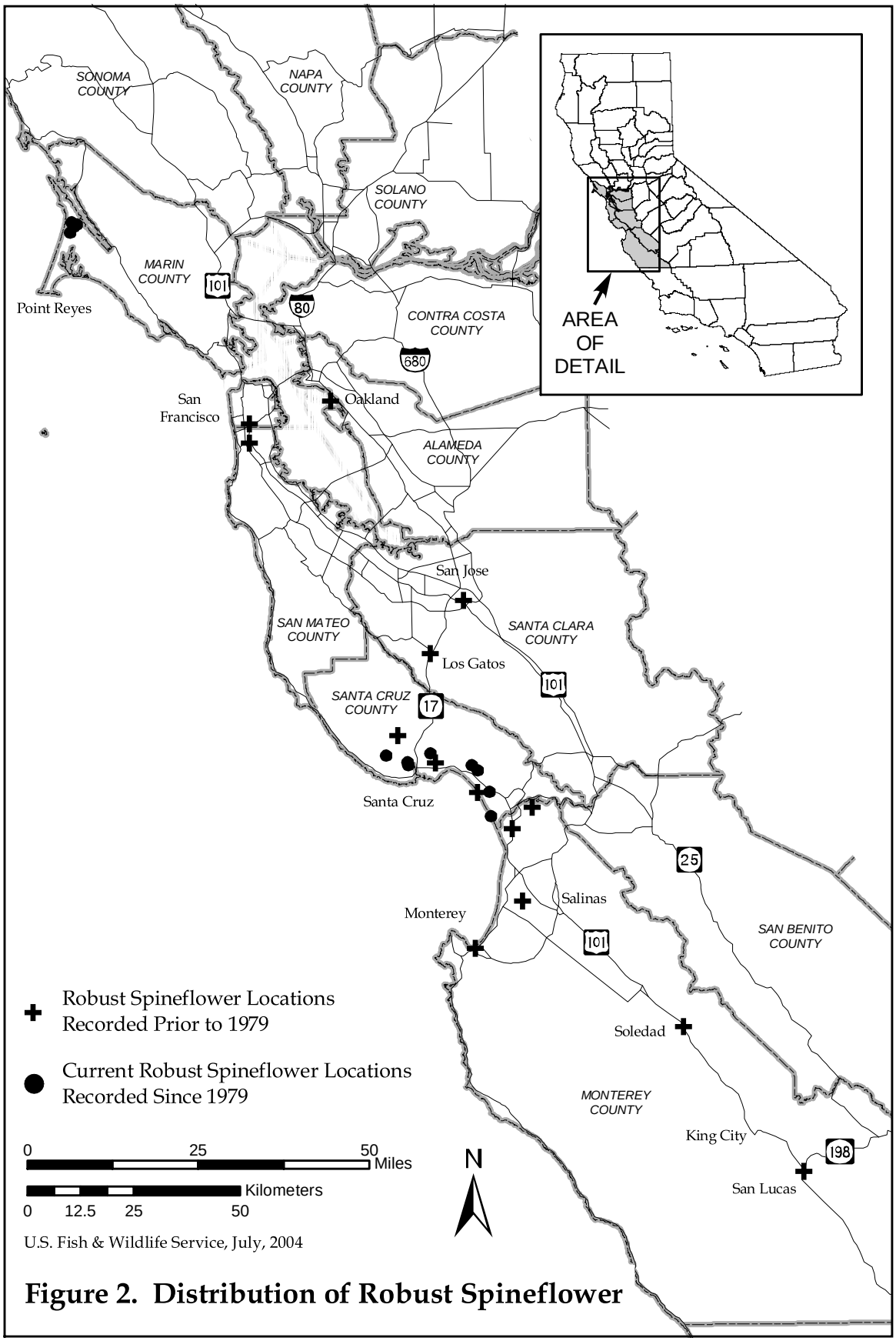

Figure 2. Distribution of Robust Spineflower

sites farther inland (*e.g.* Felton, Los Gatos) than those from where *C. robusta* var. *robusta* is currently known. A partial list of historical and current population locations that have been documented by herbarium collections and noted in the California Natural Diversity Data Base are included in Appendix B.

In 2001, collections of a spineflower gathered near Abbott's Lagoon in Point Reyes National Seashore, Marin County, were identified as *Chorizanthe robusta* var. *robusta* (B. Ertter *in litt*. 2001). The discovery of two populations here is puzzling, not only because they occur outside the known historical range of the taxon and are 100 miles away from the populations in Santa Cruz County, but because they are in an area that has been the subject of previous plant surveys. They may have been overlooked because they looked similar to other *Chorizanthe* taxa that occur in the area (J. Rodgers *in litt.* 2003). These two populations collectively totaled 10,000 individuals in 2002; the large numbers of individuals contained in these new populations is significant relative to the total number of individuals.

In addition to the two populations at Point Reyes National Seashore, we became aware of information concerning five other populations during the process of designating critical habitat for *Chorizanthe robusta* var. *robusta* that we were not aware of during preparation of the draft recovery plan. Three of these populations (Baldwin Creek, Branciforte, and Aptos) are new locations not previously described. While only scant information about the fourth population at Manresa was available at that time, the additional information available since then has been sufficient to confirm the existence of the population. The fifth new population was found at Ellicot Slough National Wildlife Refuge within the past few years; it is adjacent to populations on the Buena Vista parcel.

In summary, *Chorizanthe robusta* var. *robusta* is known from sandy soils along and adjacent to the coast of southern Santa Cruz County (ten populations) and Marin County (two populations). The distance between the southern- and northernmost populations in Santa Cruz County is approximately 30 kilometers (20 miles), while the distance between this cluster and the Point Reyes populations is approximately 160 kilometers (100 miles). The distribution of these populations is portrayed in Figures 3 and 4.

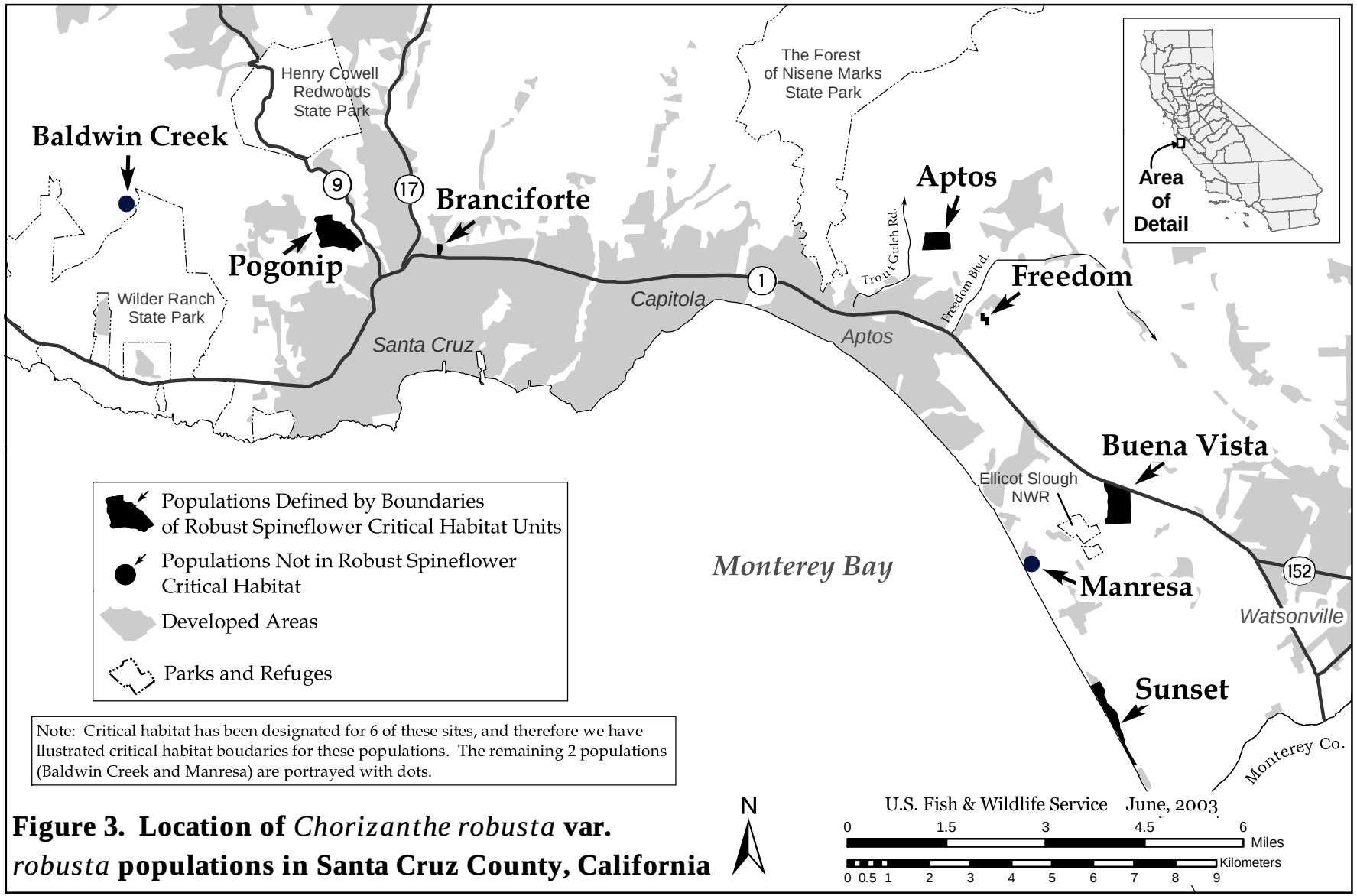

Figure 3. Location of *Chorizanthe robusta* var. *robusta* populations in Santa Cruz County, California

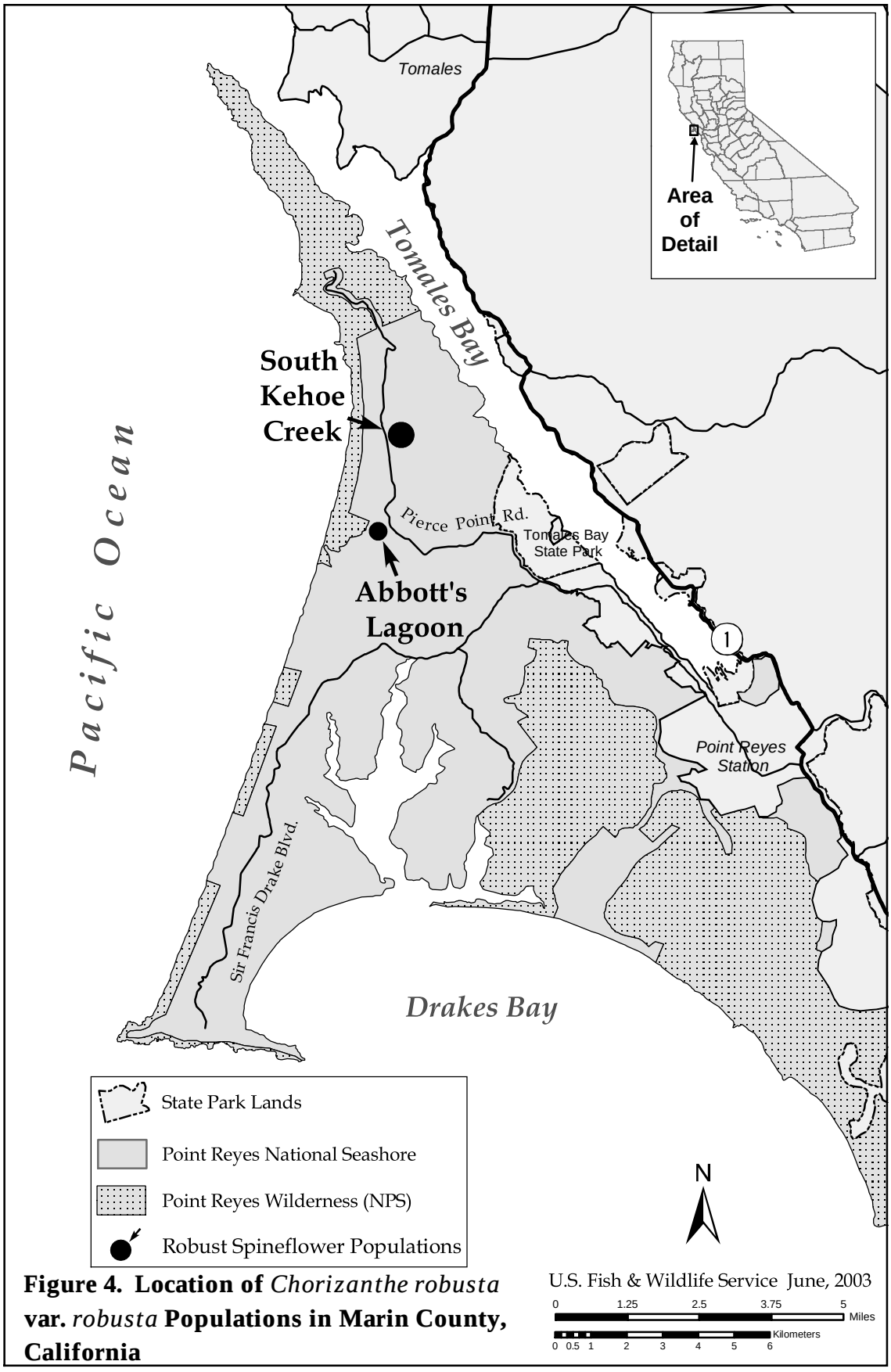

Figure 4. Location of *Chorizanthe robusta* var. *robusta* Populations in Marin County, California

F. POPULATION STATUS AND CURRENT THREATS

Many of the sites where *Chorizanthe robusta* var. *robusta* historically occurred have been modified by development and agriculture. Because many of the historical collections include only general locality information, i.e. "Colma" or "Los Gatos", it is impossible to determine when or how these populations were extirpated. However, a typical pattern of land use may have included initial conversion of wild lands to orchards, field crops, or grazing lands, followed by urban development.

The final rule listing this taxon in 1994 discussed the threats facing the four populations of *Chorizanthe robusta* var. *robusta* that were known at the time (the two Pogonip populations were considered jointly); these threats were continuing loss of habitat from residential and golf course development, recreational use, and competition with nonnative species. In addition, this taxon is vulnerable to extirpation by random (stochastic) events. The current status of the 12 populations is summarized in Table 2; threats are discussed below:

Listing Factor (A): The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

As suggested by the numerous historical locations from which *Chorizanthe robusta* var. *robusta* was once collected, many populations were extirpated by urbanization or from conversion of native habitat to agriculture. However, even where native habitat remains, natural succession leading to an increase in cover by native herbaceous and shrubby vegetation may shade out *C. robusta* var. *robusta*. Prior to European colonization of California, *C. robusta* var. *robusta*, like other members of the genus, most likely relied on natural disturbances such as natural dune erosion and formation along the coast, and in more inland areas, fires that created openings in native grassland, shrubland, and oak woodland habitats.

At some locations, invasive, nonnative species may rapidly move into *Chorizanthe robusta* var. *robusta* habitat, resulting in the reduction or elimination of *Chorizanthe robusta* var. *robusta* from that site. Nonnative species that have

Table 2. The status of 12 currently known populations for *Chorizanthe robusta* var. *robusta.* Only the most significant threats (Listing Factors A and E) are addressed here. See text for more discussion.

Population	Population ID number and Location[1]	Critical Habitat Designation	Area of Standing Plants[2]	Number of Individuals	Current Threats		Severity of Current Threats[3]	Conservation Efforts
					A	E		
1	6. Pogonip Park 1, south of Brayshaw Trail, City of Santa Cruz, Santa Cruz County	61.5 hectares (152 acres)	0.7 sq. meter (7.5 sq. feet)	40 (1990) 136 (2000) 230 (2002) 271 (2004)	√	√	Recreation / L random events / H	Designated as Resource Management Area in Master Plan
2	7. Pogonip Park 2, west of Nature Loop Trail, City of Santa Cruz, Santa Cruz County	(included in above)	6 sq. meters (60 sq. feet)	300 (1990) 675 (2000) 553 (2002) 595 (2004)	√	√	Recreation / L random events / H	Designated as Resource Management Area in Master Plan
3	10. Sunset Beach State Park, Santa Cruz County	34.8 hectares (86 acres)	1 kilometer (0.62 mile)	5,000 (1988) 100,000 (1995) 1 mil. (1998)	√		recreation / L restoration activities / L	Dune habitat restoration, annual population monitoring with adaptive management
3	14. South end of Sunset State Beach, Santa Cruz County	(included in above)	(see above)	300 (1985) 0 (1990)	√		recreation / L restoration activities / L	Dune habitat restoration, annual population monitoring with adaptive management
4	15. Buena Vista parcel, Santa Cruz County	54.6 hectares (135 acres)	4 hectares (10 acres)	1,000 (1993) 1,500 (1999) 3,700 (2003)	√	√	development (golf course) / L random events / H	Acquisition by TPL/ USFWS* Refuges recently completed
5	Ellicott Slough National Wildlife Refuge	none	2 hectares (5 acres)	?? (2003)		√	vegetation management/L recreation/L	managed in accordance with Refuge guidelines
6	16. Freedom[4], northeast of Rob Roy Junction, Santa Cruz County	4 hectares (10 acres)	1.2 hectares (3 acres)	6,000+ (1993) 2,200 (2001)	√	√	human disturbance / H	none

Population	Population ID number and Location[1]	Critical Habitat Designation	Area of Standing Plants[2]	Number of Individuals	Current Threats		Severity of Current Threats[3]	Conservation Efforts
					A	E		
7	Aptos, Santa Cruz County	28.3 hectares (70 acres)	??	3,000 (2000)	√	√	recreation/L vegetation mgmt/L random events / L	---
8	Branciforte, City of Santa Cruz, Santa Cruz County	3.6 hectares (9 acres)	0.4 hectare (1 acre)	1,000 (2002)	√	√	development / H recreation / H	City of Santa Cruz will require restoration of damaged site
9	Baldwin Creek, Santa Cruz County	none	0.4 hectare (1 acre)	1,000 (2001)	√	√	road maintenance / L random events /M	---
10	Manresa State Beach, Santa Cruz County	none	1122 sq meters (1340 sq yards)	2,000 to 20,000 (2002)	√	√	recreation / L random events / M	*Eucalyptus* removal, annual monitoring
11	Abbott's Lagoon -Pt Reyes National Seashore, Marin County	none	19.4 hectare (48 acres)	> 10,000 (2002)	√		recreation / L agriculture/M grazing/M	Baseline monitoring will start in 2003
12	South Kehoe Creek - Pt Reyes National Seashore, Marin County	none	9 hectares (22 acres)	thousands (2002)	√		recreation / L grazing/M roadside mowing/L	Baseline monitoring will start in 2003

[1] Population ID number = number assigned to the population in the California Natural Diversity Data Base.

[2] If area covered by a population was not included in occurrence reports, our staff estimated area from maps.

[3] Threat Severity codes: H = high; M = moderate; L = low

[4] Previously called "Aptos" in the draft recovery plan.

*TPL = Trust for Public Lands; USFWS = U.S. Fish and Wildlife Service

invaded habitat of *Chorizanthe robusta* var. *robusta* include *Eucalyptus globulus* (eucalyptus), *Carpobrotus edulis* and *Carpobrotus chilensis* (iceplant), *Ammophila arenaria*, *Genista monspessulana* (French broom), *Heterotheca grandiflora* (telegraph weed), and nonnative *Bromus* ssp. (brome grasses) (L. Kiguchi *in litt*. 2000, K. Lyons *in litt*. 2001, Hyland 2003).

Because many of the areas where *Chorizanthe robusta* var. *robusta* occurs have been invaded by nonnative species, long-term management activities may be necessary to maintain the open conditions in which *C. robusta* var. *robusta* can persist. One of the populations at Point Reyes National Seashore occurs within an old agricultural field that is tilled annually. Although the native habitat has been altered by agricultural practices, *C. robusta* var. *robusta* has most likely survived because the annual tilling provided the disturbance that reduced the cover of plants that would otherwise compete with it. Likewise, removal of the shrub overstory along the Pacific Gas & Electric powerline right-of-way for fuels management at the Aptos site has most likely favored the persistence of *C. robusta* var. *robusta*.

Recreational activities such as hiking at the various park units (Pogonip, Sunset and Manresa State Beaches, and Point Reyes National Seashore) likely have a slight impact on *Chorizanthe robusta* var. *robusta* habitat through trampling. Though no research has been done, field biologists familiar with the species think that low to moderate levels of impacts may benefit *C. robusta* var. *robusta* by reducing cover from other species, while high levels of impact may eliminate *C. robusta* var. *robusta* as well. Other more intensive forms of recreation, such as horseback riding and mountain bike riding, may not be compatible with the long-term conservation of *C. robusta* var. *robusta*.

Two of the sites on private land have been subjected to additional, potentially serious threats. The Branciforte parcel in the City of Santa Cruz has been targeted for high density development. We have met with the City of Santa Cruz and representatives of the landowner to discuss several options, including setting aside the entire parcel as a low-impact neighborhood park with a portion set aside for the conservation of *Chorizanthe robusta* var. *robusta* habitat, or in the event that development goes forward, to overlay a similar conservation set-aside area.

In the winter of 2003, neighborhood children dug pits and built up mounds on a site where *C. robusta* var. *robusta* occurred to construct a bicycle course. The extent of damage, and whether the site can be restored, is unknown at this time.

Individuals of *Chorizanthe robusta* var. *robusta* at the Freedom site sustained damage in the late 1990's when Aptos High School widened a narrow foot path into a path wide enough for a vehicle. The population still persists on both sides of the path on high school property, as well as on an adjacent private parcel.

Listing Factor (B): Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for any commercial, recreational, scientific, or educational purpose was not considered a threat at the time of listing, and is not considered a threat at the current time.

Listing Factor (C): Disease or Predation

Disease or predation were not considered a threat at the time or listing, nor at the current time. However, recent research on herbivory of *Chorizanthe robusta* var. *robusta* at Sunset State Beach found that individual plants with an insect herbivore (a microlepidopteran larva in the genus *Aroga* [Geliechiidae]) had a lower seed output than those plants that were treated with a pesticide (Baron 2002). Larval-infested plants tended to be found in larger plant patches (mean = 6 square meters [54 square feet]) than noninfested plants. We do not know whether this same insect herbivore occurs within other populations of *C. robusta* var. *robusta*.

Baron (2002) also observed that 11 percent of the plants in her study had seed heads removed by rabbits. For grazing, rabbits appear to favor smaller, rather than larger, plant patches that had a mean size of about 0.8 square meter (9 square feet); ungrazed patches had a mean size of 4 square meters (50 square feet). Although rabbits graze on seed heads, they are also likely responsible for carrying seed on their fur, and therefore dispersing seed between patches.

Both populations of *Chorizanthe robusta* var. *robusta* at Point Reyes National Seashore are located partially within pastures that are grazed by cattle from spring through the fall season. Presumably, the timing and intensity of grazing is such that *C. robusta* var. *robusta* has been able to persist at these locations. The extent to which cattle graze on *C. robusta* var. *robusta* is unknown at this time.

Listing Factor (D): The Inadequacy of Existing Regulatory Mechanisms

At the time of listing, *Chorizanthe robusta* var. *robusta* received minimal protection from existing Federal, State, and local laws, regulations, and ordinances. The Federal listing in 1994 and the designation of critical habitat in 2002 provided additional opportunities to achieve conservation for the species by raising the awareness of local regulatory agencies to the importance of maintaining its habitat, and by accessing Federal and State programs that allow private landowners and local agencies to implement conservation and restoration activities. These actions are discussed further in the Conservation Measures section below.

Listing Factor (E): Other Natural or Manmade Factors Affecting its Continued Existence

Shade Intolerance

Research on a related species of spineflower, *Chorizanthe pungens* var. *hartwegiana* (Ben Lomond spineflower), indicated that seedling survivorship, growth, and reproduction was more limited by shading conditions than by soil type (McGraw and Levin 1998). These findings are in alignment with observations that, when found growing in coastal scrub or chaparral habitats, *C. robusta* var. *robusta* occurs in the openings between shrubs.

Competition with nonnative annual species

Competition with nonnative species may be a threat. We do not know for certain to what extent *Chorizanthe robusta* var. *robusta* competes, in the traditional sense, for sunlight, water, soil, and nutrient resources with other plant taxa. In addition to the shade intolerance exhibited by seedlings, we also surmise that seeds of *C. robusta* var. *robusta* are not likely to germinate if the soil surface is

shaded, whether the shade is provided by "competing" annual species or by an adjacent shrub canopy.

Random extinction

Species with few populations and individuals are vulnerable to the threat of naturally occurring events causing extinction through mechanisms operating either at the genetic level, the population level, or the landscape level. Decrease in genetic variability will reduce the likelihood that individuals in a population will persist in a changing environment, and are more likely to experience reduced reproductive success due to inbreeding depression. We have recently initiated an investigation into the genetic characteristics of *Chorizanthe robusta* var. *robusta*; however, at this point in time the degree to which these characteristics contribute to the likelihood of *C. robusta* var. *robusta* being vulnerable to extinction for these reasons is unknown.

Species with few populations or those that are low in number may be subject to forces at the population level that affect their ability to complete their life cycles successfully. For example, reduced numbers of individuals may lead to a reduction in number of pollinators and subsequently seed set. Additionally, if the host plants are partially self-incompatible, reduction in population size may lead to increased self-pollination and may reduce the level of genetic variability. At the landscape level, random natural events, such as storms, drought, or fire, could destroy a significant percentage of individuals or entire populations; a hot fire could destroy a seedbank as well. Five populations of *Chorizanthe robusta* var. *robusta* support on the order of 1,000 individuals or less. The restriction of colonies to small sites increases their risk of extinction from such naturally occurring events.

The current status of, and threats facing, the 12 existing populations are summarized in Table 2. The two colonies at Pogonip Park appear to be stable, but are vulnerable to extirpation due to the small numbers of individuals and the small area of habitat that they occupy. The City of Santa Cruz Recreation Department (1998) has developed a Master Plan for the Park, which includes measures to protect the two colonies (see Conservation Measures section). A

total of 64 hectares (159 acres) of critical habitat were designated for *Chorizanthe robusta* var. *robusta* at this site (U.S. Fish and Wildlife Service 2002).

The population at Sunset State Beach is the largest, both in numbers of individuals (100,000+) and extent (1.0 kilometer [0.6 mile]), and is therefore more secure than the other populations. Some recreational activities and invasion of nonnative species, including *Ammophila arenaria*, *Ehrharta calycina* (veldt grass), and *Carpobrotus edulis* (iceplant), have affected portions of its habitat at this site. However, the California Department of Parks and Recreation has been aggressive in their efforts to remove nonnative species, and have established a monitoring program to track the status of the population (California Department of Parks and Recreation 2003). Thirty-five hectares (86 acres) of critical habitat were designated for *Chorizanthe robusta* var. *robusta* at this site (U.S. Fish and Wildlife Service 2002).

The population at Buena Vista consisted of 1,000 individuals in 1993, 1,000 individuals in 1997, 305 in 2000, and 3,700 in 2003 (California Natural Diversity Data Base 1997; Baron *in litt.* 1998, 2003). This parcel was slated for golf course development in the 1990's. After many years of effort, this parcel was purchased in 2004 for the conservation of several sensitive species, including *Chorizanthe robusta* var. *robusta* and the Santa Cruz long-toed salamander. The Trust for Public Land, California Department of Fish and Game, the California Wildlife Conservation Board, the California Coastal Conservancy, and the Service contributed funds toward the acquisition of this parcel (U.S. Fish and Wildlife Service 1998b, 2003). Fifty-five hectares (135 acres) of critical habitat were designated for *C. robusta* var. *robusta* at this site (U.S. Fish and Wildlife Service 2002). Another small population of *C. robusta* var. *robusta* was observed at Ellicott Slough National Wildlife Refuge in 2002, less than 1 mile from the populations on the Buena Vista parcel.

The Freedom population near Rob Roy Junction has fluctuated from 2,200 to upwards of 10,000 individuals over the past decade (Morgan and Kiguchi 1995, K. Lyons *in litt*. 2001). The Freedom population is bisected by a trail. A portion of a privately owned 8-hectare (20-acre) site was scraped in the early 1990's in preparation for a lot split, and an unknown number of plants were destroyed.

However, *Chorizanthe robusta* var. *robusta* has apparently recolonized the scraped area (1997). A portion of the population is located on adjacent Aptos High School lands owned by the Pajaro Unified School District. At some time during the late 1990's, the school widened what was once a narrow path through the spineflower population into a path wide enough for a vehicle (L. Kiguchi *in litt.* 2000); the path and the adjacent hillsides receive some recreational use from high school students. Four hectares (10 acres) of critical habitat were designated for *C. robusta* var. *robusta* at this site (U.S. Fish and Wildlife Service 2002). Subsequent surveys have determined that additional colonies of *C. robusta* var. *robusta* occur in the adjacent area and outside the critical habitat boundary (V. Cheap *in litt.* 2001).

The Aptos population occurs on privately owned land, along a utilities corridor right-of-way managed by Pacific Gas & Electric Company. The population was located in 2000 in preparation for a pole replacement project (D. Taylor *in litt.* 2000). At that time, the population was estimated to comprise 3,000 individuals. Other activities along the corridor included vegetation management to reduce fuel loads, and casual recreational use by local residents (R. Witthaus, Pacific Gas & Electric, pers. comm. 2003). Twenty-eight hectares (70 acres) of critical habitat were designated for *Chorizanthe robusta* var. *robusta* at this site (U.S. Fish and Wildlife Service 2002).

The Branciforte population occurs on private land along Carbonero Creek within the City of Santa Cruz. This population was located in 2000 during a stream survey, and numbers between 1,000 and 2,000 individuals (R. Morgan, pers. comm. 2000). Despite our efforts to encourage the City of Santa Cruz to acquire the 4-hectare (9-acre) parcel for a low impact park, plans are being developed to construct high density housing. During the spring of 2003, local residents established a dirt bike course on top of the *Chorizanthe robusta* var. *robusta* population. Four hectares (9 acres) of critical habitat was designated for *C. robusta* var. *robusta* at this site (U.S. Fish and Wildlife Service 2002).

The Baldwin Creek population was located in the late 1990's near the headwaters of Baldwin Creek on a private parcel adjacent to Wilder Ranch State Park, about 5 miles north-northwest of the City of Santa Cruz. The area receives some use

from the landowner and local residents (tree thinning and road maintenance), and roads and trails bisect several colonies. Because this site is fairly remote from population centers, no major changes in land use are anticipated at this time. The population was estimated to be between 1,000 and 1,500 individuals in 2001 (E. Grumbine *in litt.* 2003). Critical habitat was not designated at this site because no documentation for the population was available at the time the critical habitat designation was prepared (U.S. Fish and Wildlife Service 2002).

The Manresa State Beach population is the most seaward of all *Chorizanthe robusta* var. *robusta* populations, as it occurs in loose sand at the base of sloughing cliff faces and on cutbanks of a nearby trail that cuts from the top of the cliff down to the beach. The California Department of Parks and Recreation has, and is continuing to remove *Carpobrotus* spp. from *C. robusta* var. *robusta* habitat. In addition, a *Eucalyptus* grove that surrounds the beach trail is being thinned and contained to limit its spread into *C. robusta* var. *robusta* habitat. Fencing intended to deter beachgoers from descending the cliffs provide partial protection to the populations along the cliff front. In 2003, California Department of Parks and Recreation mapped the areal extent of standing plants as covering 1,122 square meters (12,070 square feet). The population is estimated to comprise a minimum of 2,000 individuals, and possibly as many as 20,000 (Hyland 2003). Critical habitat was not designated at this site because of confusion over the identity of the spineflower at Manresa State Beach at the time the critical habitat designation was prepared (U.S. Fish and Wildlife Service 2002).

Two population sites occur at Point Reyes National Seashore. The Abbott's Lagoon population covers approximately 19 hectares (48 acres). The largest portion of this population was fenced off from grazing in the early 1990's, and is going through succession toward coastal sage scrub. A smaller portion of the population occurs within a field that is planted with annual grasses, grazed, and plowed on an annual cycle. In addition, a portion of the population that occurs along a roadside is mowed on an annual basis. The south Kehoe Creek population is in a field that is grazed by cattle from spring through the fall season, and roadside mowing also occurs in a portion of the population (M. Coppoletta *in litt.* 2003, J. Rodgers *in litt.* 2003). *Chorizanthe robusta* var. *robusta* was not

identified from these sites earlier because they co-occur with another spineflower, *C. cuspidata*. These populations may well be even more extensive than is currently known, and additional surveys are planned for 2003. Point Reyes National Seashore is also developing a management plan for the two populations. Critical habitat was not designated at this site because documentation for the populations was not available at the time the critical habitat designation was prepared (U.S. Fish and Wildlife Service 2002).

G. CONSERVATION MEASURES

1. Available Laws, Regulations, and Ordinances

Federal Level

U.S. Fish and Wildlife Service

Chorizanthe robusta var. *robusta* was listed as an endangered species on February 4, 1994 (U.S. Fish and Wildlife Service 1994). Section 4 of the Endangered Species Act of 1973, as amended, requires us to develop a recovery plan that describes "site-specific management actions" necessary for the conservation and survival of listed species. The plan must have "objective, measurable criteria which, when met" will allow *C. robusta* var. *robusta* to be removed from the Federal list. The plan must estimate the time needed, and the cost to carry out the conservation measures. After *C. robusta* var. *robusta* is removed from the list, we must, in cooperation with the State of California, "effectively monitor for not less than 5 years" the status of *Chorizanthe robusta* var. *robusta*, and we must be prepared to restore the taxon to the list if necessary.

In 1999 we were legally challenged on our decision not to designate critical habitat at the time of listing. Therefore, we proposed critical habitat on February 15, 2001, and published a final critical habitat designation on May 28, 2002 (U.S. Fish and Wildlife Service 2002). Critical habitat is defined as the specific areas within the geographic area occupied by a species on which are found the physical or biological features (primary constituent elements) essential to the conservation of the species and that may require special management considerations or

protection, and specific areas outside the geographic area occupied by a species upon a determination that such areas are essential for the conservation of the species.

In the critical habitat designation, we identified the following four primary constituent elements:
1. Sandy soils associated with active coastal dunes and inland sites with sandy soils;
2. Plant communities that support associated species, including coastal dune, coastal scrub, grassland, maritime chaparral, and oak woodland communities, and have a structure such that there are openings between the dominant elements;
3. Plant communities that contain little or no cover by nonnative species which would compete for resources available for growth and reproduction with *Chorizanthe robusta* var. *robusta*; and
4. Physical processes, such as occasional soil disturbance, that support natural dune dynamics along coastal areas.

At the time the proposed critical habitat designation was prepared we only had adequate documentation for six critical habitat units. The designation of critical habitat is not intended to indicate that such lands are the only lands that are important to the recovery of the species, or that recovery activities can only take place on these lands. For instance, certain recovery actions, such as attempting establishment of new populations within historical range, may need to be done on lands that have not been specifically identified at this point in time. Other recovery actions, such as restoration, could occur on other sites that support *Chorizanthe robusta* var. *robusta* that were not included in the critical habitat designation, or on other sites where *C. robusta* var. *robusta* may be discovered in the future. The acreage designated as critical habitat is summarized in Table 3 below.

Table 3. Acreage of Critical Habitat designated for *Chorizanthe robusta* var. *robusta*, by Landowner

Unit Name	State	Private	City/Local	Total
A. Pogonip		2 ha (7 ac)	62 ha (152 ac)	64 ha (159 ac)
B. Branciforte		4 ha (9 ac)		4 ha (9 ac)
C. Aptos		28 ha (70 ac)		28 ha(70 ac)
D. Freedom		4 ha (9 ac)	0.4 ha (1 ac)	4 ha(10 ac)
E. Buena Vista		55 ha (135 ac)		55 ha (135 ac)
F. Sunset	35 ha (86 ac)			35 ha (86 ac)
TOTAL	35 ha (86 ac)	93 ha (230 ac)	62 ha (153 ac)	190 ha (469 ac)

Other provisions of the Endangered Species Act may also apply; some of these may assist us in the conservation and recovery of *Chorizanthe robusta* var. *robusta*:

√ Section 5 of the Endangered Species Act authorizes the Department of the Interior to acquire habitat essential to preserving listed endangered species.

√ Section 6 of the Endangered Species Act directs us to cooperate with the States to maintain adequate programs for the conservation of listed species.

√ Section 7(a) of the Endangered Species Act requires Federal agencies to use their authorities to carry out programs for the conservation of listed species and to consult with us whenever they may affect listed species or their critical habitat.

√ Section 9 of the Endangered Species Act describes prohibited acts with respect to threatened and endangered species. In general, plant species receive fewer protections than wildlife species primarily because the Endangered Species Act does not address the issue of "take" for plant species. On Federal lands or lands under Federal jurisdiction, it is a

violation to remove and reduce threatened or endangered plants to possession, or to maliciously damage or destroy them. On other lands, endangered plants may not be removed, cut, dug up, or damaged in knowing violation of any State law or regulation. Endangered plants also cannot be sold, shipped, or received in interstate or foreign commerce.

√ Section 10 of the Endangered Species Act details the exceptions to section 9 permitted in the form of recovery and incidental take permits. For plant taxa, the primary benefit of section 10 is derived from the issuance of permits for two purposes: 1) to carry out research or recovery activities that may involve removal of plants from Federal land, and 2) by our policy, the inclusion of conservation measures for plants within a habitat conservation plan which is required for the "incidental take" of wildlife species in the course of an otherwise lawful activity through a section 10 (a)(1)(B) permit.

Point Reyes National Seashore

In addition to complying with Federal laws such as the Endangered Species Act and the National Environmental Policy Act, the National Park Service also has general guidelines for natural resources management (National Park Service 1991), and the National Park Service Statement for Management (National Park Service 1985). Point Reyes National Seashore also has developed a management plan that addresses management needs of sensitive plant species (National Park Service 1980).

State Level

At the State level, the California Environmental Quality Act provides some protection for endangered species through the environmental review process. Initially, a public agency reviews a project to determine if it would negatively impact any State- or federally-listed species. If the negative project impacts are not considered significant, a formal environmental impact report is not required, and the project is granted a Negative Declaration with measures/recommendations to reduce environmental impacts. If the project's impacts are considered

significant, an environmental impact report is required, consisting of a description of existing site conditions, impact analysis, and detailed mitigation measures that would reduce project impacts to a less-than-significant level. Mitigation measures such as avoidance, fencing, or landowner education programs must be incorporated into the approved project, and may provide long-term species protection. But if no mitigation measures are feasible and if the lead agency determines that benefits of the project outweigh the environmental risks, it may approve a project that has significant environmental effects by making a statement of overriding considerations.

California Department of Parks and Recreation policy states that one of their goals is "... in concert with other agencies and organizations, to acquire and preserve outstanding examples of California species; and to acquire and perpetuate significant natural plant communities, associations, and examples of rare, endangered, or otherwise sensitive native California plants, as indicated on State and Federal lists" (Policy II.4, amended 5-4-94) (State Park and Recreation Commission 1994). A brief management plan has been developed for the Sunset State Beach Park Unit (California Department of Parks and Recreation 1998), but the California Department of Parks and Recreation acknowledges that this plan should be expanded (G. Gray *in litt.* 2000).

Private Land

For private property under the purview of the County of Santa Cruz (Freedom, Valencia, and Baldwin Creek), the General Code 16.32 of the County of Santa Cruz (Santa Cruz County 1994) applies. It allows only resource-dependent uses within environmentally sensitive habitat areas, including habitat for rare and endangered species. For proposed land divisions or developments, the County requires protection of environmentally sensitive habitats through dedication of an open space or conservation easement to protect the portion of a sensitive habitat that is undisturbed by the proposed development.

The Coastal Zone Management Act of 1972 is a Federal statute that allowed for the establishment of the California Coastal Act of 1976. The California Coastal Act established a coastal zone within which development is planned and

regulated. As required by the California Coastal Act, Santa Cruz County has developed a Coastal Land Use Plan, and it is incorporated into their County Land Use Plan (Santa Cruz County 1994). Changes to the general plan designations or zoning must be approved by the County and then certified by the California Coastal Commission. Land use decisions made by the County in the Coastal Zone are appealable to the California Coastal Commission. Although the Coastal Zone designation and California Environmental Quality Act require that unique biological resources such as *Chorizanthe robusta* var. *robusta* are considered in the planning process, any protection offered by these regulatory mechanisms is ultimately at the discretion of the local and State agencies involved.

The Environmental Quality Element of the General Plan for the City of Santa Cruz contains the following policy with respect to listed species: "Continue the protection of rare, endangered, sensitive, and limited species and habitats supporting them. . ..". The Santa Cruz Municipal Code (section 24.14.080) also states that construction, grading, or removal of vegetation is not permitted within wildlife habitats and plant communities where there are federally listed or other sensitive species prior to receiving jurisdictional permits for their removal (S. Brown *in litt.* 2003). These policies apply to the Pogonip and Branciforte sites, and any other site within the City's purview that may be found in the future.

2. Conservation Measures Undertaken

Federal

Our Refuges Division identified the Buena Vista site as a priority for addition to the Ellicott Slough National Wildlife Refuge (U.S. Fish and Wildlife Service 1998b); the Trust for Public Lands and other agencies and organizations assisted us in acquisition of this site. Expansion of the Refuge will benefit current efforts to protect habitat which would maintain and enhance populations of the Santa Cruz long-toed salamander, the California tiger salamander (*Ambystoma californiense*), and *Chorizanthe robusta* var. *robusta*.

Point Reyes National Seashore has initiated development of a management plan and monitoring protocol for the two populations on their lands. Additional

surveys will also be conducted in conjunction with the California Native Plant Society to locate other populations on suitable habitat.

State

At Sunset State Beach and Manresa State Beach, the California Department of Parks and Recreation has been actively restoring dune habitat for approximately 12 years, primarily focusing on the removal of nonnative *Carpobrotus* spp. and *Ammophila arenaria*. In addition, isolated patches of *Ehrharta calcina* and *Eucalyptus* that are invading *Chorizanthe robusta* var. *robusta* habitat are also being controlled. California Department of Parks and Recreation has also initiated a long-term monitoring program for *Chorizanthe robusta* var. *robusta* at Sunset State Beach, and is planning on establishing a monitoring program at Manresa State Beach as well.

Local.

The City of Santa Cruz has developed a Master Plan that calls for managing the Pogonip property primarily as a "low impact" park (City of Santa Cruz Recreation Department 1998). The Master Plan specifies four management actions for *Chorizanthe robusta* var. *robusta* habitat: 1) develop a management program with the California Department of Fish and Game to ensure long-term survival of the two habitat areas for *C. robusta* var. *robusta*, 2) gather and record census data on populations, 3) monitor pedestrian trail use along the Pogonip Creek Nature Trail to determine extent of impacts, and 4) install educational signs near habitat on the Pogonip Creek Nature Trail. The City has carried out annual monitoring, but other management actions have not been taken up to this point because the populations appear to be stable and are not sustaining any recreational impacts. Due to budget shortages the City has reduced its Parks staff, which currently restricts the implementation of oversight and management.

3. Potential Mitigation Measures

If projects are proposed that will adversely affect *Chorizanthe robusta* var. *robusta* or its habitat, every effort should be made to avoid direct impacts. If

direct avoidance of the *C. robusta* var. *robusta* population is not possible, mitigation efforts should try to reduce negative impacts to an insignificant level and possibly enhance *C. robusta* var. *robusta* habitat. Conditions should be incorporated into the plan prior to approval. Because there are so few populations of *C. robusta* var. *robusta*, and it is a short-lived annual species, every attempt should be made to maintain existing populations and associated habitat with minimal disturbance. Certain restoration efforts, such as removal of nonnative species, may be appropriate. However, transplanting of seed or individuals has generally been unsuccessful in establishing self-sustaining populations (Fiedler 1991), and should not be used as mitigation unless success has been proven before the project is implemented and any disturbance to the population occurs.

Possible Mitigation Measures for *Chorizanthe robusta* var. *robusta*

a. If *Chorizanthe robusta* var. *robusta* is thought to occur on the site, confirmation from a qualified botanist should be obtained first.

b. If the proposed project will directly remove part or all of a *Chorizanthe robusta* var. *robusta* population, reconfigure project to avoid such direct impacts.

c. If the proposed project will have secondary impacts in the form of alteration of ecologic processes (hydrology, edaphic conditions, pollinator availability) on part or all of a site supporting a population, reconfigure the project to avoid such secondary impacts.

d. If the proposed project will have secondary impacts in the form of increasing traffic from humans, bicycles, horses, and pets, use fencing, barriers, and signing as appropriate to reduce such impacts.

e. If the proposed project will impact habitat through application of herbicides or pesticides, either through runoff or overspray, reconfigure the project to avoid such impacts.

f. If the proposed project will have secondary impacts in the form of increasing opportunities for the encroachment of nonnative plants, measures should be taken to minimize the effects, including limiting new landscaping to native species, using only appropriate local native species in seed mixes, and including weed control measures in restoration efforts.

g. If the proposed project will have temporary impacts on part or all of a site supporting a population of *Chorizanthe robusta* var. *robusta*, make efforts to minimize temporary impacts, and take steps to restore the site if this can be done without causing further long-term damage.

H. RECOVERY STRATEGY

Summary of Status. Based on available information, *Chorizanthe robusta* var. *robusta* once ranged over five counties, from the San Francisco Bay area south to Monterey County (see Figure 2). The recent discovery of *C. robusta* var. *robusta* at Point Reyes National Seashore has increased this range north to Marin County, on the north side of the San Francisco Bay. However, intervening populations from San Mateo, Santa Clara, and Alameda Counties have disappeared.

The large size of *Chorizanthe robusta* var. *robusta* populations recently found at Point Reyes National Seashore also significantly alters our view of the status of the taxon overall. The overall numbers of individuals are larger than previously known. However, the geographic distribution is such that the largest populations are found at the very northern and very southern end of the plant's distribution. Other populations are not only small, but they are concentrated in the Santa Cruz area.

With the discovery of new populations on National Park Service lands, the opportunity to conserve and manage *Chorizanthe robusta* var. *robusta* populations on park and refuge lands has increased. Although impacts associated with recreation and restoration activities do occur on the these parcels, the greatest human-related threats to *C. robusta* var. *robusta* remain on the three parcels of private land where the plant's habitat is impacted by development and associated secondary impacts. Low numbers of individuals in all but the largest

populations at Point Reyes National Seashore and Sunset State Beach remain a concern due to the potential for local extirpations.

Recovery Strategy. Maintaining the geographic distribution of *Chorizanthe robusta* var. *robusta* needs to be a key factor in the recovery strategy for this plant. The presence of large populations at Point Reyes National Seashore and Sunset State Beach provide some level of confidence that *C. robusta* var. *robusta* will not go extinct in the near future. However, much genetic variability, and with it, the opportunity to contribute to the long-term survival of the plant could be lost if the smaller populations clustered around Santa Cruz are allowed to go extinct. Therefore, criteria for recovery should focus on maintaining populations within all the portions of the range of the plant. We have grouped the 12 populations into 4 geographic recovery units as described in Table 4 below.

Table 4. Geographic recovery units for recovery planning.

Recovery Unit	**Populations**
Point Reyes	South Kehoe Creek, Abbotts Lagoon
Northern Santa Cruz	Baldwin Creek, Pogonip 1, Pogonip 2, Branciforte
Aptos	Freedom, Aptos
Southern Santa Cruz	Buena Vista, Ellicott, Manresa State Beach, Sunset State Beach

Specific efforts should focus on conserving, managing, and enhancing currently known habitat throughout the range of the species, conducting management-oriented research, and reestablishing populations within the historical range of the species if appropriate habitat can be located. We advocate an adaptive management approach, wherein management is modified if monitoring indicates that objectives to attain the desired condition have not been met, or if newly available information indicates that objectives need to be modified. The priorities for achieving recovery are as follows:

1. Protect habitat for *Chorizanthe robusta* var. *robusta* at all existing sites.

Protection of *Chorizanthe robusta* var. *robusta* habitat at the various park and refuge sites should be achievable because each of the managing agencies have within their mandates the protection of sensitive resources. These sites include Pogonip Park (City of Santa Cruz), Sunset State Beach and Manresa State Beach (California Department of Parks and Recreation), Abbott's Lagoon and South Kehoe Creek (Point Reyes National Seashore), and Buena Vista and Ellicott Slough (Ellicott Slough National Wildlife Refuge).

Achieving protection for populations on private lands is more problematic. City of Santa Cruz and County of Santa Cruz authorities for conservation of sensitive resources include the use of conservation easements and other tools to ensure that future development does not impact habitat for *Chorizanthe robusta* var. *robusta* on private lands. In addition to regulating future activities, all interested parties, including us, California Department of Fish and Game, the County, and nongovernmental organizations such as the Trust for Public Lands, California Native Plant Society, and The Land Trust of Santa Cruz County should work together to acquire key parcels for conservation and recovery of *C. robusta* var. *robusta*.

2. Manage habitat for *Chorizanthe robusta* var. *robusta* at existing sites**.** Habitat that is under protective status should be managed to ensure that ecosystem processes vital to the long-term survival of *Chorizanthe robusta* var. *robusta* are allowed to function. Such ecosystem processes include edaphic and hydrologic function, nutrient cycling, pollinator activity, and seed dispersal mechanisms. Management plans should be developed and implemented for specific sites that identify the most appropriate activities for maintaining ecosystem function and habitat enhancement.

Activities to maintain ecologic functions and to achieve habitat enhancement could include: controlled burning, reduction of nonnative plant invasion, and control of recreational activities that would cause undue soil erosion or compaction. For additional discussion on potential management needs, see the earlier section on Special Management Considerations.

3. Conduct management-oriented research. Research on *Chorizanthe robusta* var. *robusta* that contributes to a better understanding of what it requires for long-term viability is needed for developing and revising more appropriate management goals, and to assist in evaluating potential habitat for introduction.

Taxonomic studies are needed to identify the phenotype/genotype of the 12 known populations, and populations at other historical or new sites that are located in the future. Life history studies of *Chorizanthe robusta* var. *robusta* are needed to determine which of its characteristics affect its persistence. Habitat characterization studies are needed, particularly focusing on edaphic and hydrologic conditions, plant community associations, and seed characteristics. Additional research on pollination ecology should be carried out to build on the studies done by Murphy (2003). Research needs include understanding how *C. robusta* var. *robusta* responds to different types and intensities of natural and managed disturbance.

4. Establish populations in appropriate habitat within the historical range of the species. Attempting to establish new populations can be expensive, logistically difficult, and is rarely successful (Fiedler 1991, Falk and Olwell 1992). This effort should be considered because, although large populations exist at the northern and southern extremes of its range (Point Reyes National Seashore and Sunset State Beach, respectively), the nine other populations clustered in the Santa Cruz area comprise small numbers of individuals and small amounts of habitat and are vulnerable to extirpation from random events. Many of the sites where *Chorizanthe robusta* var. *robusta* was historically collected no longer provide suitable habitat. However, an assessment of other possible suitable sites should be conducted to determine if an outplanting program is feasible.

5. Review and revise recovery criteria as new information becomes available. Based on the effectiveness of the efforts to preserve and manage habitat, to establish new populations within the historical range of the taxon, and the information resulting from research, recovery criteria and recovery actions for *Chorizanthe robusta* var. *robusta* should be revised in the future, as necessary.

6. Develop and implement an outreach program. Increasing public awareness of this variety of spineflower will facilitate efforts to preserve it and associated habitat. Brochures can be prepared and distributed at Pogonip Park, Sunset State Beach, Manresa State Beach, Point Reyes National Seashore, Ellicott Slough National Wildlife Refuge, and to private landowners with potential habitat to enlist the public in efforts to conserve *Chorizanthe robusta* var. *robusta*. Educational signs can also be posted at appropriate locations on park lands.

II. RECOVERY

A. RECOVERY GOAL

The recovery goal for *Chorizanthe robusta* var. *robusta* is to conserve viable self-sustaining populations in its natural habitat such that protection of the Endangered Species Act is no longer necessary.

B. RECOVERY OBJECTIVES AND CRITERIA

Objectives: The objectives for the recovery of this species are first to reclassify its status from endangered to threatened, and ultimately to delist it completely.

Reclassification criteria can be quantified in terms of: 1) minimum numbers of individuals and populations, 2) abundance and distribution of habitat, 3) its ability to be self-sustaining and survive over some period of time, and 4) the removal or management of potential threats.

Preliminary Downlisting Criteria:

1. Within each recovery unit, the number of populations and acreage of occupied habitat for each population has been protected as specified in Table 5 below.

2. Habitat in each protected population has been appropriately managed and restored.

3. Population monitoring shows a stable or increasing trend in population size or density during favorable precipitation years over at least 10 years.

3a. For populations under 4 hectares (10 acres) and below 10,000 individuals, the average number of individuals in favorable (non-drought) precipitation years should meet or exceed the target population levels given in Table 5 during a period of at least 10 years that encompass a normal rainfall cycle (including periods of drought and wet years). Zedler and Black (1989) analyzed historical precipitation records for San Diego and calculated the

Table 5. Recovery goals for each geographic recovery unit.

Recovery Unit	**Population**	**Conservation Achieved Through: A) approved and implemented management plan with monitoring, or B) conservation easement**	**Maintain Occupied Habitat**	**Maintain Target # of Individuals**
A. Point Reyes	Abbott's Lagoon	A	48 acres	10,000
	South Kehoe Creek	A	22 acres	current number ("thousands")
combined total	maintain 2 of 2		70 acres	10,000+
B. Northern Santa Cruz	Baldwin Creek	B	??	1000
	Pogonip 1	A	habitat limited to 0.25 acre	100
	Pogonip 2	A	habitat limited to 1 acre	500
	Branciforte	B	habitat limited to 1 acre	1000
combined total	maintain 3 of 4		2 acres	
C. Aptos	Aptos	A	10 acres	2000
	Freedom	B	5 acres	2000
combined total	maintain 2 of 2		15 acres	
D. Southern Santa Cruz	Buena Vista	A	12 acres	1500
	Ellicott Slough	A	2 acres	500
	Manresa State Beach	A	5 acres	2,000 - 20,000
	Sunset State Beach	A	50 acres	10,000
combined total	maintain 4 of 4		60 acres	10,000

minimum monitoring period that would be needed to expect a range of annual rainfall that includes 50 percent of the total range in variation of annual rainfall. An analogous period should be calculated for the central coastal California area where *Chorizanthe robusta* var. *robusta* occurs, and the 10-year monitoring period should be reassessed if it would not adequately capture the range of precipitation in the region.

3b. For populations over 10,000 individuals or 4 hectares (10 acres), monitoring based on density or frequency may be more appropriate. Currently, this would apply to populations at Sunset State Beach, Abbott's Lagoon, South Kehoe Creek, and possibly Aptos and Buena Vista.

Delisting Criteria:
In addition to the above, achieve the following:

1. The total number of populations has increased to at least 18, at least 15 of which have an average population of 1,000 individuals in favorable (non-drought) rainfall years over at least 10 years (beyond the downlisting monitoring period).

   We selected the target of 18 populations based on the goal of maintaining the taxon within each of the four geographic recovery units depending on the number, size, and level of protection that is afforded current populations in each of those units, as follows: Point Reyes unit - increase populations by 0; Northern Santa Cruz unit - increase populations by 3; Aptos unit - increase populations by 3; Southern Santa Cruz unit - increase populations by 0. Note that if the target number of 18 populations is reached, the newly discovered or newly established populations will not necessarily be distributed within these units as we are defining them now.

   This criterion could be achieved by a combination of the following:

   a. discovering additional populations and achieving an equivalent level of conservation for them as above.

   b. establishing new populations through an outplanting program. The populations would need to be self-sustaining, and be protected through

conservation measures equivalent to above. Surveys should be conducted within the species' historical range to determine the availability and defensibility of suitable habitat. Priority should be placed on establishing populations within the historical range of the species as well as in the two geographic recovery units (Northern Santa Cruz and Aptos) that have smaller populations, if suitable habitat can be located.

All of these criteria should be reevaluated and updated as new information about the species and its habitat becomes available.

III. STEPDOWN NARRATIVE

1. Protect habitat with existing *Chorizanthe robusta* var. *robusta* populations.

Chorizanthe robusta var. *robusta* populations and habitat on park and refuge lands are afforded some level of protection, which we expect will continue. Those populations on private lands are the most vulnerable to human impacts. Populations on private lands include Baldwin Creek, Branciforte, Freedom, and Aptos.

1.1 Inform landowners

Affected private landowners should be informed of efforts to recover *Chorizanthe robusta* var. *robusta*, invited to participate in recovery efforts, and be asked to prevent inadvertent or intentional destruction of habitat. Affected private landowners include:

Baldwin Creek: Campbell

Branciforte: First Federal Properties

Aptos: various unknown private landowners, Pacific Gas & Electric has right-of-way

Freedom: Pajaro Unified School District (Aptos High School) and private

1.2 Coordinate with agencies that have jurisdiction over these private lands

With respect to project approval, the Branciforte parcel is under the jurisdiction of the City of Santa Cruz; all the other private parcels are under the jurisdiction of the County of Santa Cruz. In addition to these local planning agencies, others parties that might be involved with recovery activities could include the California Department of Fish and Game, the California Native Plant Society, universities, botanic gardens and herbaria, and other individuals knowledgeable about the plant and its habitat. Should any projects be proposed for these sites, the agency with local jurisdiction should ensure that conservation measures are adequate to protect *Chorizanthe*

robusta var. *robusta* populations and habitat. We and the California Department of Fish and Game should also be involved in reviewing project proposals, and any mitigation plans and management plans developed in association with the project.

1.3 Establish protection agreements and secure habitat sites with permission of the landowners

Local agencies can solicit private landowner participation and support for recovery, establish open space or conservation easements by the property owner, establish permanent resource management easements, or acquire lands through fee acquisition from willing sellers. Local lands trusts, such as the Land Conservancy of Santa Cruz County, could assist with these efforts. The Branciforte parcel is the highest priority for securing habitat protection because the threats from development are imminent. The Rob Roy site is also a high priority for securing habitat protection because it is vulnerable to human impacts. The remaining private parcels are within more rural areas of the County, and would be a lower priority for these efforts.

2. Manage habitat with existing *Chorizanthe robusta* var. *robusta* populations

Chorizanthe robusta var. *robusta* populations and habitat on park and refuge lands are either currently being managed, or management plans are being developed currently (or, in the case of Buena Vista, in the near future). Populations and habitat on private lands are the most vulnerable to human impacts, and are in the most need of improved management. Populations on private lands include Baldwin Creek, Branciforte, Freedom, and Aptos.

2.1 Eliminate or minimize threats on private lands

Threats identified to date are addressed below. Any additional threats should be addressed as they are identified, or as additional populations are discovered or established. As new threats become apparent, management actions should be implemented to reduce or eliminate their effects on *Chorizanthe robusta* var. *robusta* populations and habitat.

Baldwin Creek: road maintenance
Branciforte: trampling and other recreational impacts resulting from use by local residents
Aptos: recreational use by local residents
Freedom: trampling and recreational impacts resulting from use by high school students

2.2 Eliminate or minimize additional threats on parks and refuge lands

Any additional threats that arise on parks and refuge lands that have not been addressed in management plans should be addressed as they arise. Management actions should be implemented that will reduce or eliminate their effects on *Chorizanthe robusta* var. *robusta*. All management actions should include monitoring for effectiveness, and future management should be contingent on results of monitoring.

3. Conduct management-oriented research

Research is needed to provide baseline information about the life history characteristics and habitat characteristics of this variety of spineflower. This baseline information will ensure that appropriate management actions are undertaken, and will contribute to the long-term survival of this variety and its habitat. Also, baseline information about life history and population characteristics will assist in developing other appropriate recovery criteria.

3.1 Clarify the taxonomic identity of *Chorizanthe robusta* var. *robusta* populations at known sites

The identity of *Chorizanthe robusta* var. *robusta* populations at known sites should be clarified through biochemical or morphologic studies, by comparing them to other populations of *Chorizanthe* in the *Pungentes* section in the Monterey Bay and Point Reyes area. This is necessary to ensure that the status of *C. robusta* var. *robusta* and other closely related spineflower taxa, such as *C. pungens* var. *pungens* (Monterey spineflower), is appropriately

assessed. In addition, having this information will assure that the appropriate spineflower taxon at each site is the correct target of recovery actions.

3.2 Investigate life history and population characteristics

Identify *Chorizanthe robusta* var. *robusta* life history phases (*e.g.*, seed viability, seedling mortality, juvenile mortality, floral production, seed production) and population characteristics which have the greatest effect on population growth, species persistence, and the dynamics of populations composed of several colonies.

3.3 Determine habitat characteristics important to the species

To some extent, the identification of physical and biological characteristics of the habitat that are important to the establishment, growth, reproduction, and the long-term persistence of *Chorizanthe robusta* var. *robusta* was initiated during the process of designating critical habitat. However, *C. robusta* var. *robusta* occurs in open patches within several other plant communities (coastal sage scrub, maritime chaparral, oak woodland). Therefore, it is important to do additional research to determine how the distribution of shrubs within these communities influences the presence of *C. robusta* var. *robusta* (patch dynamics) and how this taxon responds to different types and intensities of disturbance within those communities.

3.4 Determine management actions that may be necessary to maintain optimal habitat conditions for the species

As habitat conditions are better understood, management activities that provide and maintain optimal conditions for *Chorizanthe robusta* var. *robusta* need to be identified. This may include methods for maintaining the mosaic of open patches within the shrub community (*e.g.*, scraping, discing, fire management, and/or selective removal of shrubs, small mammal management), removal of nonnative species that compete with *C. robusta* var. *robusta*, the use of grazing as a management tool, and eliminating or minimizing human-caused disturbance of habitat.

3.5 Monitor each population at regular intervals

Monitoring the status of each population should be standardized to include demographics, population trends, and potential threats. Population monitoring protocol for the few large populations (*e.g.*, Sunset State Beach, Point Reyes National Seashore) may need to be tailored to focus on the areal extent of occupied suitable habitat, while population monitoring for the smaller populations can feasiblely focus on the number of individuals. The data should be used to evaluate the status of *Chorizanthe robusta* var. *robusta* and the success of any management actions that are being implemented. Management actions should be modified accordingly if changes in management are needed.

4. Establish new *Chorizanthe robusta* var. *robusta* populations in appropriate habitat within its historical range

Although additional populations of *Chorizanthe robusta* var. *robusta* have been located in the last 5 years, the total number of populations is small. Moreover, with the exception of the two populations at Point Reyes National Seashore, all of the known populations of *C. robusta* var. *robusta* are concentrated in the Monterey Bay area. Establishing new populations within the spineflower's known historical range would contribute to the long-term viability of the species. If new populations are successfully established, it will reduce the likelihood that a catastrophic event could result in the extinction of this taxon.

4.1 Locate appropriate habitat for outplanting

Habitat with physical characteristics and associated vegetation similar to existing *Chorizanthe robusta* var. *robusta* habitat in the historical range of the variety should be selected for outplanting sites. Surveys for appropriate sites should include any historical locations that still support potentially suitable habitat. Management of these new *C. robusta* var. *robusta* sites would be facilitated by protected access, public/conservation group ownership, and/or effective conservation easements. The Midpeninsula Regional Open Space District owns and manages lands scattered throughout the San Francisco

Peninsula in San Mateo and Santa Clara Counties. These lands offer one of the best opportunities to find suitable sites for outplanting new populations of *C. robusta* var. *robusta*. We, the Midpeninsula Regional Open Space District, and other interested organizations should assess whether any suitable outplanting sites exist on Midpeninsula Regional Open Space District lands. Other potentially suitable sites in the Northern Santa Cruz and Aptos geographic recovery units should also be identified

4.2 Conduct experimental habitat enhancement

Experimental habitat enhancement should be conducted in preparation for new transplants of *Chorizanthe robusta* var. *robusta*. Habitat enhancement may include scraping, raking, mowing, burning, selective removal of other species, and reduction or elimination of human-caused disturbance if it is a threat.

4.3 Apply appropriate habitat enhancement techniques

Based on results from habitat enhancement experiments, appropriate techniques to enhance new habitat should be applied at the potential introduction sites.

4.4 Conduct propagation experiments to determine the best techniques for developing material to use in introductions

Propagation techniques need to be developed and a *Chorizanthe robusta* var. *robusta* seed source produced from garden populations before trying to conduct outplantings to establish new off-site populations. The first step in off-site propagation is to determine feasibility by evaluating factors such as seed viability, storage, germination, and survival in an experimental environment.

4.5 Conduct experimental introductions

Chorizanthe robusta var. *robusta* seed from garden-propagated plants should be transplanted to identified introduction sites. The transplants on these sites should be monitored closely to determine the feasibility of expanding efforts to establish populations through such introductions.

4.6 Develop a protocol to guide introductions

A protocol should be developed to help guide efforts to introduce new populations. The protocol should include such information as what type of propagules to use, the type of post-planting care required, spacing specifications, and optimal scheduling for planting activities.

4.7 Conduct large-scale introductions on appropriate sites

If experimental introductions appear to be successful, efforts should be expanded to establish populations over larger areas and to more numerous sites.

4.8 Monitor newly established populations

Introduced populations should be mapped and monitored to determine long-term success of establishing new populations. Once established, both the transplanted population of *Chorizanthe robusta* var. *robusta* and its habitat should be monitored frequently and routinely.

5. Review and revise recovery criteria as new information becomes available

Results of all recovery activities should be evaluated and incorporated into updated management and recovery guidelines for the taxon. Expertise of the Center for Plant Conservation should be utilized in assisting with these actions.

5.1 Redefine recovery criteria

When sufficient monitoring and research results become available, the quantitative recovery criteria should be reviewed to determine if they are still adequate and appropriate. Of particular importance to assess will be trends indicated by population monitoring, and results of research into life history and population dynamics (see recovery actions 3.2 and 3.5). In addition, if results of a genetic taxonomic study determine that the numbers of *Chorizanthe robusta* var. *robusta* populations are either fewer or greater than our current understanding, recovery criteria for downlisting (which involve establishing additional populations) most likely would have to be modified. If criteria are not adequate or appropriate, they should be revised, incorporating the new information.

5.2 Update management and recovery guidelines

In accordance with adaptive management principles, the goals for recovery and the ability to achieve them through management actions should be revised, if monitoring and research indicate the need.

6. Develop and implement an outreach program

Increasing public awareness of *Chorizanthe robusta* var. *robusta* will facilitate efforts to preserve it and its associated habitat. Brochures can be prepared and distributed at the park and refuge units, and educational signs can be posted at appropriate locations at these units. Educational materials should be provided to private landowners to enlist their support in the conservation of *C. robusta* var. *robusta*, and to describe the grant programs, such as the Partners for Fish and Wildlife Program, that are available to assist them with habitat restoration efforts.

IV. IMPLEMENTATION SCHEDULE

The table that follows is a summary of scheduled actions and costs for the *Chorizanthe robusta* var. *robusta* recovery plan. It is a **guide** for meeting the objectives discussed in Part II of this plan. The table includes the following five elements, which are further discussed below: 1) the action priority; 2) the action number and description; 3) the action duration; 4) lead agencies which are responsible for performing the actions; and 5) cost estimates.

1. Priority. The actions identified in the Implementation Schedule are those that, in our opinion, should recover *Chorizanthe robusta* var. *robusta*. However, the actions are subject to modification as dictated by new findings, changes in the status of the taxon, and the completion of recovery actions. The priority for each action is given in the first column of the implementation schedule. The priority number for each recovery action is assigned one of the following levels:

Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2: An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery of the taxon.

2. Action Number and Description. The action number and description are extracted from the step down narrative found in Part III of the recovery plan. Please refer back to this narrative for a fuller description of each action.

3. Action Duration. The Action Duration column indicates the number of years estimated to complete the action if it is a discrete action, or whether it is a continual or ongoing action. Continual and ongoing actions are defined as follows:

Cont = Continual. Action will be implemented on an annual basis once it has begun.

Ong = Ongoing. Action is currently being implemented and will continue until no longer necessary for recovery.

4. Responsible Parties. We have identified agencies and other parties that we believe are primary stakeholders in the recovery process. The list of potential stakeholders is not limited to the list below; other stakeholders are invited to participate. For each action, the most logical lead agency (based on authorities, mandates, and capabilities) has been identified as the responsible party with an asterisk (*). For some actions, the responsible party essentially assumes all responsibility for implementing the action; for other actions, the responsible party may assume responsibility for coordinating other stakeholders as well. The following abbreviations are used to identify primary stakeholders for each recovery action:

Acronyms for Responsible Agencies (* designates lead agency):

CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CPC	Center for Plant Conservation
LCSC	Land Conservancy of Santa Cruz County
MROSD	Midpeninsula Regional Open Space District
NPS	National Park Service (Point Reyes National Seashore)
PVT	Private parties
SCR	City of Santa Cruz
SCCO	Santa Cruz County
UC	University of California or California State University
USFWS	U.S. Fish and Wildlife Service

5. Cost Estimates. The estimated costs are shown for annual recovery actions within a 7-year period. Total costs for ongoing and continuous actions are calculated based on the estimated 20-year timeframe to delisting. Numbers represent thousands of dollars. The estimated costs include salaries for individuals who would carry out each action. Typically, the responsible party (or lead agency) assumes the largest share of the cost, with other stakeholders shown as contributors. Estimated costs in this recovery plan do not commit any agency or party to an expenditure of funds. Therefore, initiation and completion of these actions is subject to the availability of funds as well as other constraints affecting the stakeholders involved.

IMPLEMENTATION SCHEDULE FOR *CHORIZANTHE ROBUSTA* VAR. *ROBUSTA* RECOVERY PLAN												
PRIORITY #	ACTION #	ACTION DESCRIPTION	DURATION (YEARS)	RESPONSIBLE PARTY	TOTAL COST ($1000's)	YR1	YR2	YR3	YR4	YR5	YR6	YR7
Need 1. Protect habitat with existing populations of *Chorizanthe robusta* var. *robusta*												
2	1.1	Inform landowners	5	USFWS* PVT	1	0.2	0.2	0.2	0.2	0.2	0	0
2	1.2	Coordinate with jurisdictional agencies	5	FWS* SCCO SCR CDFG PVT	5	1	1	1	1	1	0	0
2	1.3	Establish protection agreements or acquire habitat	5	SCCO SCR LCSC PVT	TBD							
Need 1 Subtotal Cost: $6,000 + TBD + Does not include cost of conservation easement or acquisition												
Need 2. Manage habitat with existing populations of *Chorizanthe robusta* var. *robusta*												
2	2.1	Eliminate, minimize threats on private lands, with monitoring	Cont.	SCCO LCSC PVT CDFG	27 20 20 0	4 5 5 0	2 5 5 0	2 2.5 2.5 0	2 2.5 2.5 0	2 2.5 2.5 0	1 2.5 2.5 0	1 0 0 0

IMPLEMENTATION SCHEDULE FOR *CHORIZANTHE ROBUSTA* VAR. *ROBUSTA* RECOVERY PLAN												
PRIORITY #	ACTION #	ACTION DESCRIPTION	DURATION (YEARS)	RESPONSIBLE PARTY	TOTAL COST ($1000's)	YR1	YR2	YR3	YR4	YR5	YR6	YR7
2	2.2	Eliminate, minimize threats on park and refuge lands, with monitoring	Cont.	CDPR	27	4	2	2	2	2	1	1
				NPS	10	2	2	2	2	2	1	1
				USFWS	10	2	2	2	2	2	1	1
				SCR	10	0.5	0.5	0.5	0.5	0.5	0.5	0.5
				CDFG	0	0	0	0	0	0	0	0
Need 2 Subtotal Cost: $124,000												
Need 3. Conduct management-oriented research												
2	3.1	Clarify taxonomic identity of populations	2	USFWS*	15	10	5	0	0	0	0	0
				NPS	3	0	0	0	0	0	0	0
				UC	0	0	0	0	0	0	0	0
2	3.2	Investigate life history and population characteristics	2	USFWS*	10	5	5	0	0	0	0	0
				NPS	5	1	1	1	1	1	0	0
				UC	0	0	0	0	0	0	0	0
2	3.3	Determine habitat characteristics	2	USFWS*	10	5	5	0	0	0	0	0
				NPS	5	2.5	2.5	0	0	0	0	0
				UC	0	0	0	0	0	0	0	0
2	3.4	Determine management actions to maintain optimal habitat conditions	2	USFWS*	20	0	0	10	10	0	0	0
				NPS	10	0	0	5	5	0	0	0
				UC	0	0	0	0	0	0	0	0
2	3.5	Monitor populations	Cont.	USFWS*	10	0.5	0.5	0.5	0.5	0.5	0.5	0.5
				CDPR	20	1	1	1	1	1	1	1
				NPS	20	1	1	1	1	1	1	1
				SCR	10	0.5	0.5	0.5	0.5	0.5	0.5	0.5

IMPLEMENTATION SCHEDULE FOR *CHORIZANTHE ROBUSTA* VAR. *ROBUSTA* RECOVERY PLAN												
PRIORITY #	ACTION #	ACTION DESCRIPTION	DURATION (YEARS)	RESPONSIBLE PARTY	TOTAL COST ($1000's)	YR1	YR2	YR3	YR4	YR5	YR6	YR7
Need 3 Subtotal Cost: $138,000												
Need 4. Establish populations within historical range												
2	4.1	Locate appropriate habitat for outplanting	2	USFWS* MOSD	10 5	0 0	0 0	5 2.5	5 2.5	0 0	0 0	0 0
2	4.2	Conduct experimental habitat enhancement	2	USFWS* MOSD UC	10 0 0	0 0 0	0 0 0	0 0 0	5 0 0	5 0 0	0 0 0	0 0 0
2	4.3	Apply appropriate habitat enhancement techniques	2	USFWS* MOSD UC	20 0	0 0	0 0	0 0	0 0	10 0	10 0	0 0
2	4.4	Conduct propagation experiments to develop material	2	USFWS* CPC UC	10 0 0	5 0 0	5 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
2	4.5	Conduct experimental introductions	2	USFWS* CPC UC	10 0 0	0 0 0	0 0 0	0 0 0	5 0 0	5 0 0	0 0 0	0 0 0
2	4.6	Develop protocol to guide introductions	2	USFWS* CPC UC	5 0 0	0 0 0	0 0 0	0 0 0	0 0 0	5 0 0	0 0 0	0 0 0
2	4.7	Conduct large-scale introductions	2	USFWS* CPC UC	20 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	10 0 0	10 0 0

IMPLEMENTATION SCHEDULE FOR *CHORIZANTHE ROBUSTA* VAR. *ROBUSTA* RECOVERY PLAN												
PRIORITY #	ACTION #	ACTION DESCRIPTION	DURATION (YEARS)	RESPONSIBLE PARTY	TOTAL COST ($1000's)	YR1	YR2	YR3	YR4	YR5	YR6	YR7
2	4.8	Monitor newly established populations	10	USFWS*	10	0	0	0	0	0	2	2
				CPC	0	0	0	0	0	0	0	0
				UC	0	0	0	0	0	0	0	0
Need 4 Subtotal Cost: $100,000												
Need 5. Review and revise recovery criteria as new information be comes available												
3	5.1	Redefine recovery criteria	1	USFWS*	2	0	0	0	0	0	0	2
				NPS	0	0	0	0	0	0	0	0
				CDPR	0	0	0	0	0	0	0	0
				CPC	0	0	0	0	0	0	0	0
3	5.2	Update management and recovery guidelines	1	USFWS*	4	0	0	0	0	0	0	4
				NPS	0	0	0	0	0	0	0	0
				CDPR	0	0	0	0	0	0	0	0
				CPC	0	0	0	0	0	0	0	0
Need 5 Subtotal Cost: $6,000												
Need 6. Develop and implement an outreach program												
3	6	Outreach program	1	USFWS*	0.5	0	0	0.5	0	0	0	0
				NPS	0.5	0	0	0.5	0	0	0	0
				CDPR	0.5	0	0	0.5	0	0	0	0
				SCR	0.5	0	0	0.5	0	0	0	0
Need 6 Subtotal Cost: $2,000												
TOTAL COSTS: $376,000 + TBD												

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VI. APPENDICES

APPENDIX A. Explanation of Recovery Priority System

The Recovery Priority System uses the criteria of degree of threat, recovery potential, and taxonomy (level of genetic distinctiveness) to assign all listed species a number (1-18). A fourth factor, conflict, is a supplementary element that gives priority, within each category, in preparation of recovery plans to species that are, or may be in conflict with construction or development projects. Thus, the species retains its numerical rank and acquires the letter designation of "C", indicating conflict (1C-18C). The Recovery Priority System is discussed in detail in U.S. Fish and Wildlife Service (1983).

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic genus	1	1C
	High	Species	2	2C
	High	Subspecies	3	3C
	Low	Monotypic genus	4	4C
	Low	Species	5	5C
	Low	Subspecies	6	6C
Moderate	High	Monotypic genus	7	7C
	High	Species	8	8C
	High	Subspecies	9	9C
	Low	Monotypic genus	10	10C
	Low	Species	11	11C
	Low	Subspecies	12	12C
Low	High	Monotypic genus	13	13C
	High	Species	14	14C
	High	Subspecies	15	15C
	Low	Monotypic genus	16	16C
	Low	Species	17	17C
	Low	Subspecies	18	18C

APPENDIX B: Historical collections of *Chorizanthe robusta* var. *robusta*.

Population ID#[1] and location[2]	**Collector & Date**	**Ownership**	**Status[3] and Comments**
1. Alameda AC	Bolander 1866; Greene 1891	-	extirpated
2. Colma SMC	Brandegee 1905; Suksdorf 1913	-	extirpated
3. Felton SCC	Thompson 1913	-	extirpated
4. Los Gatos SCLC	Leeds 1888	-	extirpated
5. north of Santa Cruz (Paul Sweet Rd.) SCC	Morgan 1977	private	unknown. Population has not been relocated
6. Pogonip Park, s of Brayshaw Trail SCC	Morgan 1986	City of Santa Cruz	extant
7. Pogonip Park, w of Nature Loop Trail, SCC	Morgan 1986	City of Santa Cruz	extant
8. Rodeo Gulch Road, Soquel, SCC	Hesse 1960 (also Belshaw 1936)	private	unknown. Potential sighting in 2000 needs to be checked
9. Manresa State Beach, SCC	Raven 1957 Morgan 1979	Calif. Dept of Parks & Recreation	extant
10. Sunset State Beach, SCC	Reveal & Broome 1987; Morgan 1988	Calif. Dept. of Parks & Recreation	extant
11. 1.5 mi. east of Watsonville Junction, MC	Belshaw 1936	-	extirpated [4]
12. Del Monte, MC	Elmer 1902	-	extirpated [4]
13. 1 mi. south of San Lucas, MC	Keck & Stockwell 1935	-	extirpated [4]
14. S end of Sunset State Beach, SCC	1985	Calif Dept. of Parks & Recreation	extirpated
15. East of Manresa State Beach (Buena Vista), SCC	Lake 1993	Calif. Dept. of Fish and Game, U.S. Fish and Wildlife Service	extant
16. NE of Rob Roy Junction, SCC	Morgan 1993	Aptos School District/ private	extant
(no #) Santa Cruz, SCC	Jones 1881	-	corresponds to Pogonip pops?
18. Ocean View District of San Francisco, SFC	Congdon 1889	-	extirpated

19. San Jose, SCLC	Parry 1882	-	extirpated
20. near Soledad, MC	Congdon 1881	-	unknown [5]
21. 4 mi from Moss Landing on Pojano [Pajaro] Road, MC	Abrams 1903	-	extirpated [5]
22. Salinas Valley near Monterey Bay, MC	Abbott 1889	-	extirpated [5]

[1]Identification # corresponds to that used in the California Natural Diversity Data Base (CNDDB)

[2] County codes are as follows: AC =Alameda County, MC =Monterey County, SCC = Santa Cruz County, SCLC = Santa Clara County, SMC = San Mateo County, SFC = San Francisco County.

[3] Populations identified as "extirpated" are presumed extirpated by the Service; this opinion may differ from that of CNDDB.

[4] Barbara Ertter noted that specimen is intermediate in characteristics between Monterey spineflower (*Chorizanthe pungens* var *pungens*) and robust spineflower (*Chorizanthe robusta* var *robusta*).

[5]Barbara Ertter noted that specimen is closer in characteristics to Monterey spineflower (*Chorizanthe pungens* var *pungens*) than robust spineflower (*Chorizanthe robusta* var *robusta*).

APPENDIX C: Summary of Agency, Peer, and Public comments on the Draft Recovery Plan

In September 2000 we released the Draft Recovery Plan for the Robust Spineflower (U.S. Fish and Wildlife Service 2000a) for a 60-day comment period that ended on November 20, 2000, for all interested agencies and members of the public (U.S. Fish and Wildlife Service 2000b).

In response to the release of the draft plan, we received six letters, each containing varying numbers of comments. Copies of the draft recovery plan were sent to approximately 65 interested parties. Of these, three individuals (Kathy Lyons, Joe Rigney, and Laurie Kiguchi), were asked to peer review the document; all three peer reviewers responded. Peer reviewers were selected for their familiarity with the taxonomic group, a geographic area, and/or jurisdictional issues.

The number of parties responding, by affiliation:

State agencies	1
Academia/professionals	5

Summary of Significant Comments and Our Responses

We reviewed all of the comments received during the comment period. Comments that were editorial or technical in nature, or were updating the information in the draft recovery plan, have been incorporated into the appropriate sections of the recovery plan. We did not receive any comments that we considered controversial or significant in the sense of making a difference in the fundamental way that recovery of *Chorizanthe robusta* var. *robusta* is being approached.

Comment: Several commenters suggested that more discussion should be included regarding the need to manage vegetation to benefit *Chorizanthe robusta* var. *robusta*. Two types of needed management were identified: management of native shrubs that are shading out *C. robusta* var. *robusta*, and management of invasive, nonnative species that may outcompete *C. robusta* var. *robusta*.

Response: We agree, and have added additional discussion of vegetation management to the document.

Comment: Several commenters asked that additional discussion regarding the role of disturbance in maintaining habitat for *Chorizanthe robusta* var. *robusta* be included in the plan.

Response: We agree, and have added additional discussion to the section entitled Habitat Description and Critical Habitat.

Comment: One commenter stated that regional planning efforts are needed, and that through the plan, we should be encouraging the County of Santa Cruz to develop a regional Habitat Conservation Plan that would include landowner incentives for preservation and management of habitat.

Response: We agree that regional planning efforts could contribute to the recovery of this as well as other species in the County. We have discussed the concept of initiating a county-wide or smaller regional scale Habitat Conservation Plan effort with the County Planning Department. However, the County is unable and unwilling to do so at this time.

APPENDIX D: Threats identified for *Chorizanthe robusta* var. *robusta* and Recovery Plan Recommended Management Actions

Threat (Listing Factor)	Recovery Actions (Action #)	Recovery Criteria
Habitat destruction from development, recreation, other human activities (A)	Eliminate, minimize threats on private lands, with monitoring (2.1); Eliminate, minimize threats on park and refuge lands, with monitoring (2.2); Monitor populations (3.5)	1, 2, 3
Habitat alteration due to competition with nonnative species (A, E)	Investigate life history and population characteristics (3.2); Determine habitat characteristics (3.3); Determine management actions to maintain optimal habitat conditions (3.4); Monitor populations (3.5)	1, 2, 3
Habitat alteration due to shading by shrub overstory (A, E)	Investigate life history and population characteristics (3.2); Determine habitat characteristics (3.3); Determine management actions to maintain optimal habitat conditions (3.4); Monitor populations (3.5)	1, 2, 3
Predation by insects, small mammals (Factor C)	Determine management actions to maintain optimal habitat conditions (3.4); Monitor populations (3.5)	1
Grazing by cattle (Factor C)	Eliminate, minimize threats on park and refuge lands, with monitoring (2.2); Monitor populations (3.5)	1
Inadequate regulatory mechanisms (Factor D)	Inform landowners (1.1); Coordinate with jurisdictional agencies (1.2); Establish protection agreements or acquire habitat (1.3); Outreach program (6.0)	1, 2, 3
Small population size, stochasticity (E)	Clarify taxonomic identity of populations (3.1); Locate appropriate habitat for outplanting (4.1); Conduct experimental habitat enhancement (4.2); Apply appropriate habitat enhancement techniques (4.3); Conduct propagation experiments to develop material (4.4); Conduct experimental introductions (4.5); Develop protocol to guide introductions (4.6); Conduct large-scale introductions (4.7); Monitor newly established populations (4.8); Redefine recovery criteria (5.1); Update management and recovery guidelines (5.2)	1, 2, 3